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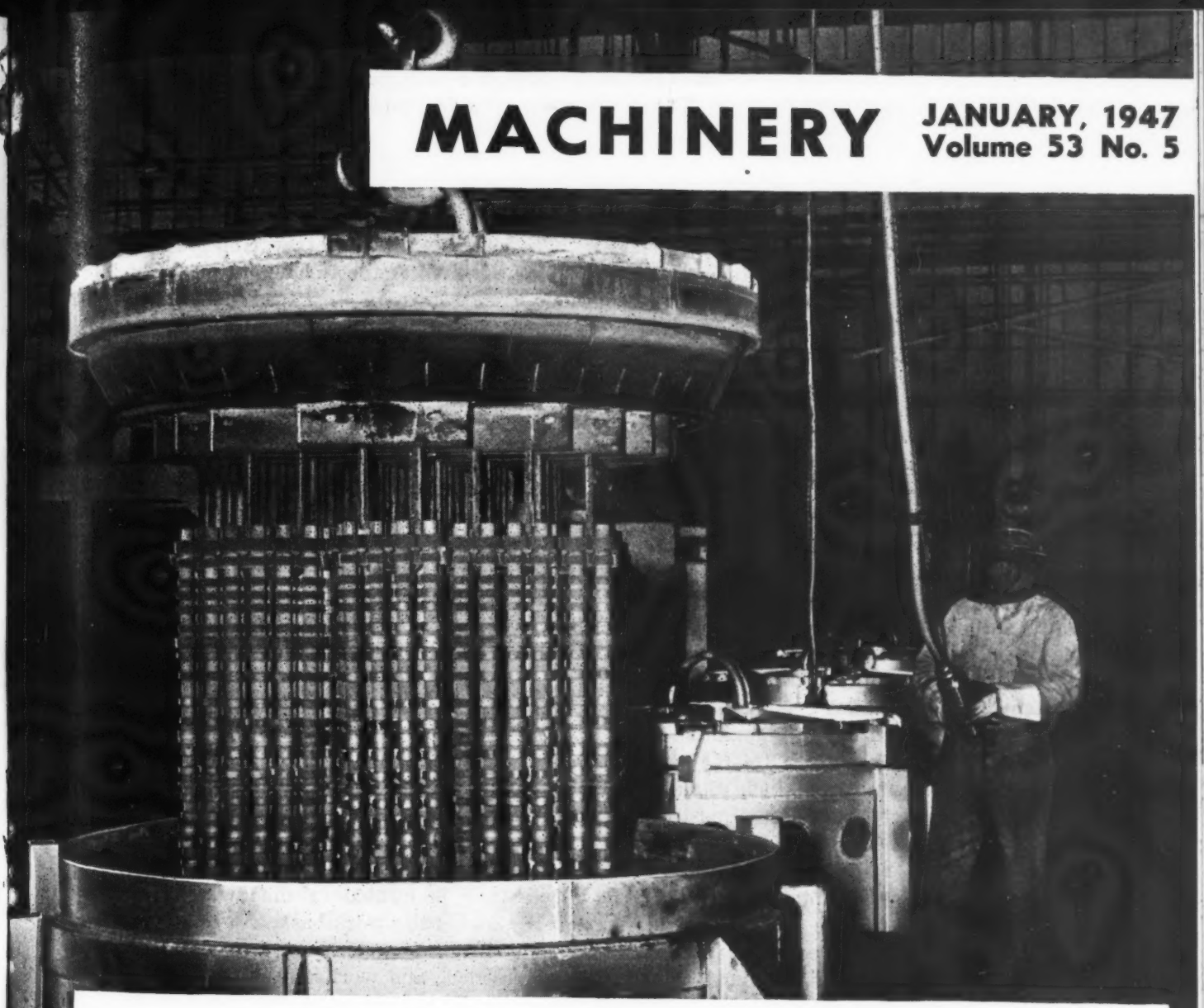


Modern Heat-Treating Methods in an Automobile Plant

By CHARLES H. WICK

A VARIETY of methods can often be applied to obtain identical results in manufacturing metal products. This is particularly true in the heat-treatment of steel, where the choice of furnace, heating medium, cycle, and other factors provide numerous combinations for attaining satisfactory results. In its post-war modernization of manufacturing facilities, the Buick Motor Division, General Motors Corporation, Flint, Mich., has adopted heat-treating methods that it believes to be the most economical and efficient for the mass production of automobile parts.

All of the Buick motor and differential parts are heat-treated in a central area which occupies 47,000 square feet of factory floor space. Normalizing, carburizing, hardening, and tempering operations are performed in sixty-four heat-treating furnaces having capacities of from 400 to 4000 pounds per hour. These furnaces range from relatively small batch type tempering furnaces, 20 inches in diameter by 36 inches deep, to hardening furnaces having a hearth area 4 feet wide by 33 feet long and a height from hearth to arch of 30 inches.

Small bolts, which are usually made from S A E 1335 steel, are clean-hardened in a radiant-tube, controlled-atmosphere, rotary-hearth furnace at a production rate of 600 pounds per hour. Formerly these bolts were hardened in

a screw-retort open furnace. This practice resulted in the formation of a considerable amount of scale which had to be removed by heavy pickling. Now, with the atmosphere in the furnace controlled and an immediate quench of the bolts, the carbon content of the bolts remains unchanged and almost no scale is formed, thus dispensing with the pickling operation and increasing production. The quenching tank is kept separate from the furnace to prevent contamination of the quenching medium.

Commercial generator gas is fed directly into the furnace at the rate of 250 cubic feet per hour. The constant flow of gas maintains a positive pressure in the work chamber and prevents infiltration of air. Water-cooled oil seals are also built into the furnace.

The furnace is approximately 10 feet in diameter by 8 feet 6 inches high. The rotary hearth has a diameter of 7 feet 7 1/2 inches. The outer edge of the hearth is turned at a maximum speed of 17.3 inches per minute by a 3/4-H.P. motor, which is connected to a 30.563-inch pitch diameter, 96-tooth sprocket on the center post of the furnace by a chain and speed reducer.

Natural-gas fired radiant tubes are located both above and below the rotary hearth. Each of the eight tubes, four above and four below the hearth, make three 180-degree turns in the furnace. The temperature is maintained at 1550 degrees F. Two foot-actuated, hydraulic-operated, lift doors, 9 inches high by 15 inches wide, are located adjacent to each other.

The bolts are placed in trays and fed manually onto the hearth of the furnace through the left-hand door shown in Fig. 1. When a tray has completed its circuit around the furnace, which takes one hour and ten minutes, the operator removes it from the right-hand door by means of tongs and empties the bolts into the rotary shell oil-quench tank, as shown. A screw on the inside of the rotary quench basket carries the bolts up to a conveyor, which feeds them through an alkali washer to remove the oil. The bolts fall from the end of the washer conveyor into a work-basket used in the tempering operation.

The heat at which the tempering furnace is operated depends upon the physical properties required in the bolts, and varies from 800 to 900 degrees F. The conventional, vertical-retort, batch type, recirculation furnaces used for tempering are electrically heated and have a power-input of 45 kilowatts. Heat is radiated to the charge by the electrical windings surrounding the retort. Varying temperatures exist in different parts of the furnace, the highest temperature being the top. For this reason, the thermocouple tube is located in the swinging cover, directly above the work-basket.

Temperature-time curves at various locations in the furnace and work-basket for the tempering of connecting-rod bolts are shown in Fig. 2.

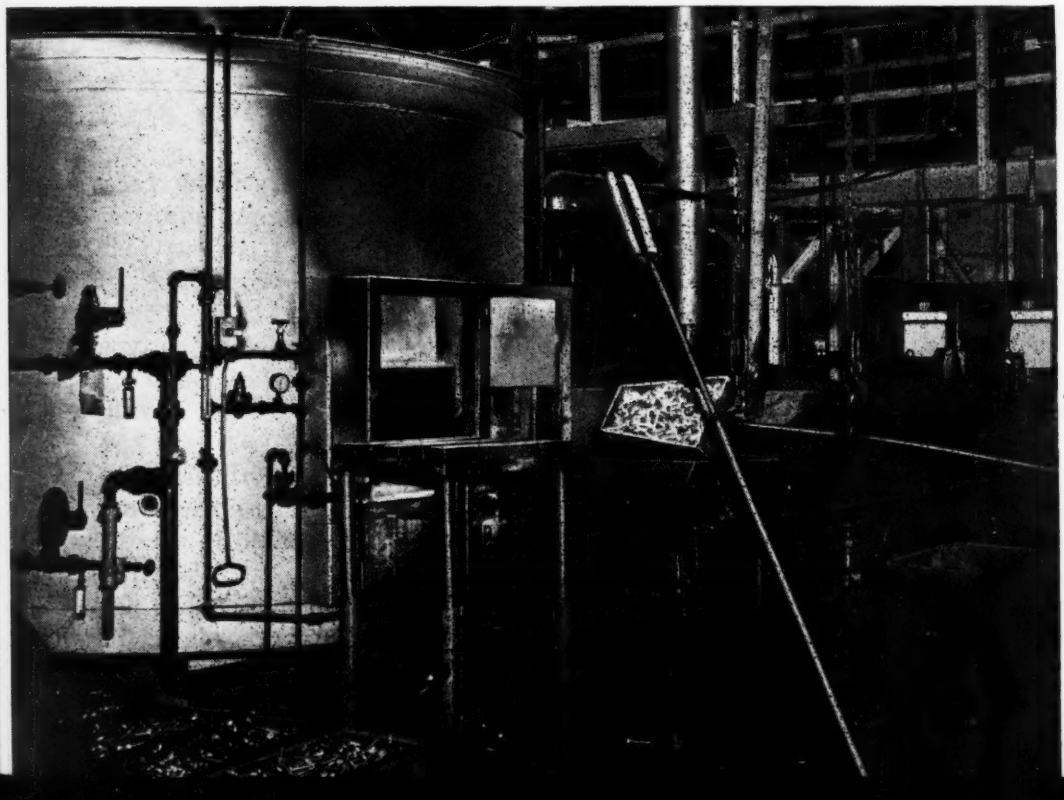


Fig. 1. A Tray of Heat-treated Bolts being Removed from a Radiant-tube, Controlled-atmosphere, Rotary-hearth Furnace and Emptied into a Rotary Shell Oil-quench Tank

The dimensions of these bolts are shown at *X*. Each bolt weighs 0.092 pound, and approximately 1100 pounds of bolts are charged into a single furnace. The container in which the bolts are held weighs 143 pounds. This results in a load density, which is equal to the ratio of the weight of load and fixture to the weight of an amount of steel equal in volume to the retort, of 44 per cent. Such a relatively high load density is necessary in this application for economical operation. A 30 per cent load density for batch type, pit furnaces is considered most desirable.

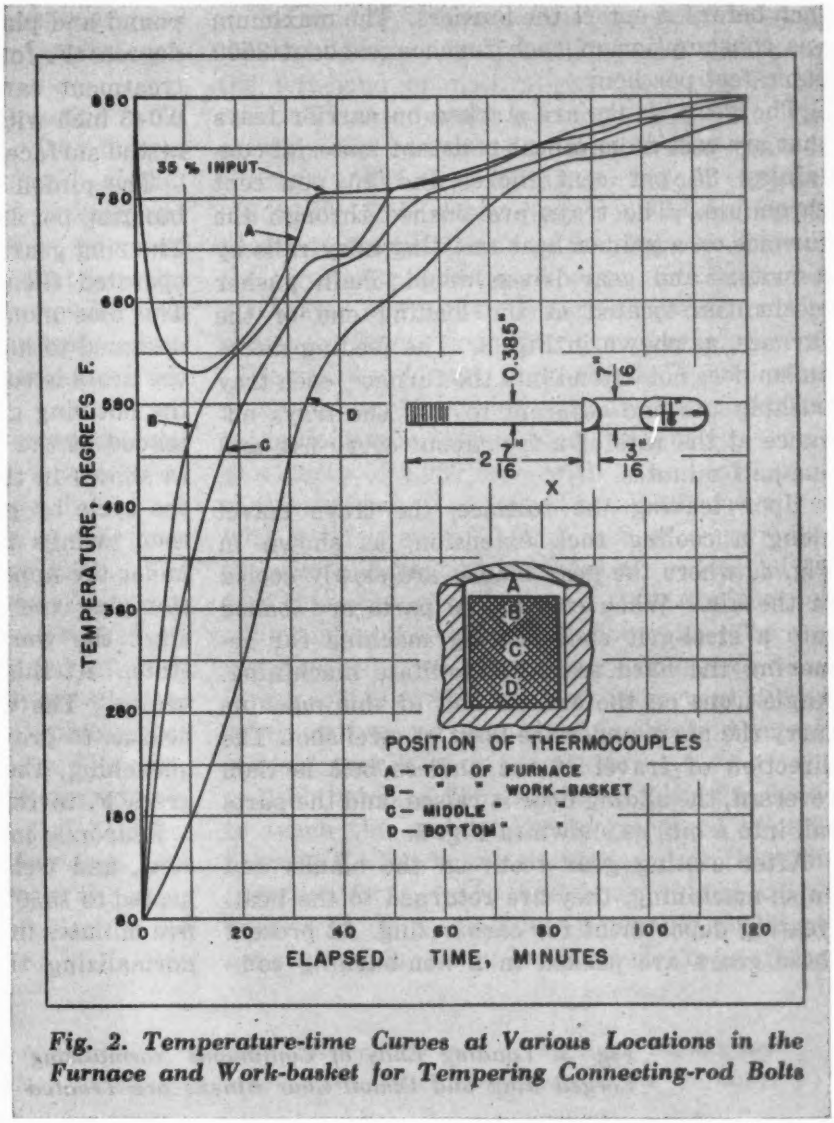


Fig. 2. Temperature-time Curves at Various Locations in the Furnace and Work-basket for Tempering Connecting-rod Bolts

This dense load causes a large drop in the temperature of the furnace at the beginning of the cycle, as shown by curve *A*, which shows the variation in temperature at the top of the furnace. Curves *B*, *C*, and *D* show temperature variations during the cycle at different positions in the work-basket. For this particular bolt and load density, the furnace temperature is set at 860 degrees F. Until a temperature of 785 degrees F. has been reached, the input to the furnace is maintained at 100 per cent, or 45 kilowatts. At this temperature, an input controller automatically reduces the input to 35 per cent, or 15.75 kilowatts.

This lower heat input is nearer the rate at which the load can absorb the heat without a high temperature differential between different parts of the load, and thus provides approximate temperature uniformity throughout the load before the tempering range is attained. This is evidenced by the merging of curves *A*, *B*, *C*, and *D* as they near the maximum temperature.

Ring and pinion gear blanks made from S A E 1320 steel, and weighing approximately 10 pounds each, are normalized after forging to refine their grain structure and soften them for the machining operations. The gear blanks are normalized at 1700 degrees F. in one of two continuous furnaces that were designed and constructed by Buick. Each furnace has a capacity of 4000 pounds per hour and a hearth 4 feet wide by 30 feet long. For hearth type, continuous furnaces, 40 pounds of work per square foot of hearth area is considered best for uniformity of heating.

The normalizing furnaces are of the three-temperature-zone, two-valve control design. Each zone employs three gas burners on each side of the hearth, or a total of eighteen burners per furnace. Natural gas having a heating value of 1000 BTU per cubic foot and regulated to a pressure of 1/4 pound per square inch is mixed with air having a pressure of 1 pound per square

inch before it enters the burners. The maximum gas consumption of each furnace is about 3500 cubic feet per hour.

The gear blanks are stacked on carrier trays that are cast from a heat-resistant material containing 35 per cent nickel and 15 per cent chromium. The trays are pushed through the furnace on a pair of heat-resisting alloy rails by a motor- and gear-driven double-chain pusher mechanism located at the loading end of the furnace, as shown in Fig. 3. The feeding mechanism does not extend into the furnace, each tray pushing the one adjacent to it. The trays advance at the rate of a foot about every five and one-half minutes.

Upon leaving the furnace, the trays travel along a cooling rack extension, as shown in Fig. 4, where the gear blanks are slowly cooled in the air. When cooled, the parts are loaded into a steel-grit shot-blasting machine for removing the hard scale to facilitate machining. Angle-irons on the endless belt of this machine carry the parts under the blast of steel shot. The direction of travel of the endless belt is then reversed, the sliding door is raised, and the parts fall into a bin, as shown in Fig. 5.

After cutting gear teeth on the blanks and finish-machining, they are returned to the heat-treating department for carburizing. At present these gears are packed in a non-burning compound and placed in a furnace operated at 1700 degrees F. for a period of twelve hours. This treatment carburizes the parts to a depth of 0.045 inch with approximately 1 per cent carbon at the surface.

The pinion gears are removed from the carburizing pot and directly quenched in an oil tank. The ring gears are quenched in a battery of air-operated Gleason presses, as shown in Fig. 6. The dies mounted on this press are especially designed to handle the ring gears. Operation of the press is completely automatic. After placing the hot ring gear on the lower die, which is extended at the front of the machine for loading, as shown in the illustration, the operator starts the cycle by pressing a button. The lower die then swings back into the quenching position under the upper die, and the upper die descends, clamping the gear with sufficient pressure to align the work while it is still in the plastic state. At this point, the flow of quenching oil begins. The work is free to contract, but is so held as to prevent warping or distortion. After quenching, the gears are tempered at 325 degrees F. to relieve stresses.

Rear-axle main shafts made from SAE 1330 steel, and weighing about 20 pounds each, are heated to 1550 degrees F. for one hour and forty-five minutes in a furnace similar to that used for normalizing the ring and pinion gear blanks.

Fig. 3. Loading Ends of Continuous Normalizing Furnaces in which Forged Ring and Pinion Gear Blanks are Treated prior to Machining

The production is 3200 pounds per hour, and approximately 4050 cubic feet per hour of natural gas is used for firing.

At the completion of this heat-treating cycle, the shafts are quenched in water. The flanged end of the shaft is kept out of the quench, so that it will remain soft for subsequent drilling and other machining. The shafts are then tempered in a continuous, vertical type oven that is maintained at a temperature of 800 degrees F. This treatment results in a Brinell hardness corresponding to a 3.2 millimeter diameter of impression.

The vertical tempering oven, a cross-sectional end view of which is shown in Fig. 7, which was designed and built by Buick, results in quite a saving in floor space. The output of this oven is 220 shafts, or 4400 pounds, per hour. The time that the shafts spend on the oven conveyor is nearly two hours, and the effective heating time is one hour. At every fourth link of chain conveyor *C*, corresponding to a linear distance of approximately 16.16 inches, is a station *H* on which eight shafts are hung vertically. The chain conveyor is turned by a geared motor at 0.62 feet per minute. The oven is 23 feet 5 inches high, 11 feet 7 inches wide, and 9 feet deep. The reason for the first 180-degree turn of the chain on the large sprocket *S* is to permit slack in the chain to be taken up.

The cold shafts are loaded at *L*, proceed up the right-hand side of baffle *B*, and then down the left-hand or natural-gas fired side of the oven. The gas burner is located at *A*. The base of the oven contains an open water tank *W* through which the shafts pass before they are unloaded. This water quench is for cooling the shafts to permit handling and has no effect on the physical properties, because the shafts are not heated above their critical temperature. The shafts are finally cleaned by tumbling in a barrel.

Camshafts forged from S A E X-1015 steel, and weighing 17 pounds each, are gas carburized in radiant-tube, batch type, pit furnaces to a case depth of 0.080 inch, with 1 per cent carbon at the surface. The forged camshafts are plated with a thickness of 0.0005 inch of copper, and the cam and bearing surfaces are machined before carburizing, so that only those surfaces are subjected to the carburizing operation. The copper plate is left on the accessory drive-gear blank in the center of the camshaft to prevent it from being carburized and thus facilitate the subsequent gear-cutting operation.

Each batch of 256 camshafts takes five hours to reach the carburizing temperature of 1700 degrees F., ten hours maintenance at this temperature, from two to three hours to cool to 1500 degrees F., and two hours for rapid cooling to approximately room temperature in a forced

Fig. 4. Unloading Ends of the Normalizing Furnaces Shown in Fig. 3. The Gear Blanks are Slowly Cooled in the Air as They Travel along the Cooling Rack Extensions of the Furnaces

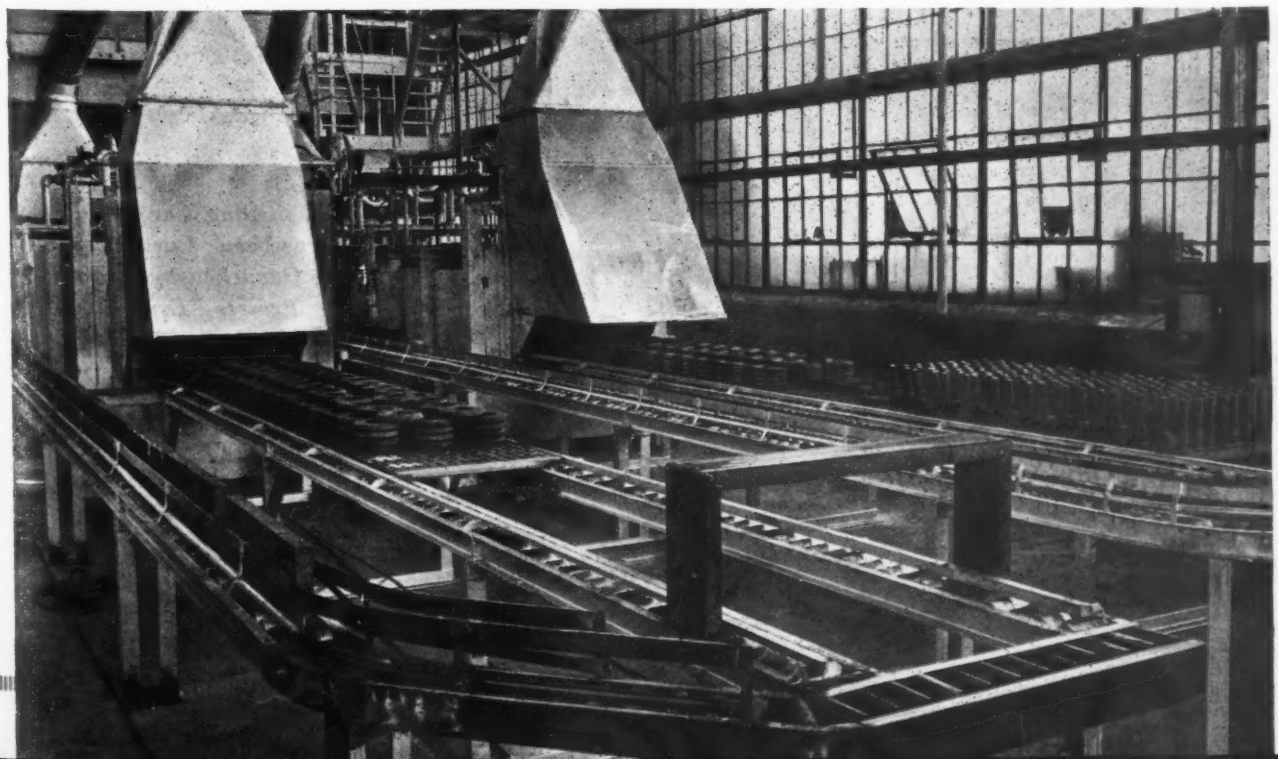


Fig. 5. Normalized Gear Blanks are Subjected to a Spray of Steel Shot in Order to Remove Hard Scale and Facilitate Machining

suction cooling pit. A battery of eight carburizing furnaces and four suction coolers, as shown in Fig. 8, are used for this operation.

The reason for using batch type furnaces for such operations is that the depth of case specified, which necessitates subjection of the parts to the carburizing temperature for from ten to twelve hours, would require a continuous furnace of a size that would be impractical for economical operation. Camshafts were formerly pack-carburized, but this method was dirtier and less flexible, and resulted in higher labor costs.

The carburizing furnaces, which each have a capacity for 4350 pounds, or 256 camshafts, have an inside diameter of 6 feet 6 inches and an inside height of approximately 6 feet. They are placed in concrete pits 12 feet in diameter by 10 feet deep, which are covered with steel grating, and rest on angle-iron bases, so that the top of the furnace, with the cover in place, projects 3 feet 9 inches above the floor. The camshafts, which are approximately 3 feet long, hang from the under side of the cover into a 4-foot diameter shield placed concentrically in the retort.

Sixteen vertical, natural-gas fired, spark-plug ignited, radiant U-tubes are spaced evenly around the furnace between the firebrick wall and the work shield. With a fixture weight of 320 pounds and a camshaft load of 4350 pounds, these furnaces operate at an efficient load density of 28 per cent.

A dual gas system in which the carburizing gas is supplied for part of the cycle only is used for this operation. The carburizing medium is natural gas, which is introduced directly into the furnace retort through a 2-inch standard pipe at the rate of 30 cubic feet per hour. The principal constituent of the natural gas is methane,

Fig. 6. Ring Gears that have been Carburized are Quenched by Means of Presses Especially Designed to Prevent Distortion

Fig. 7. Cross-sectional End View of Vertical Oven Used for Tempering Rear-axle Main Shafts at the Rate of 220 Shafts, or 4400 Pounds, per Hour

which is unstable at the carburizing temperature and forms hydrogen and the desired carbon. A carrier gas, which is incapable of sooting in the carburizing temperature range and contains no oxidizing or decarburizing components, is also introduced into the furnace, at the rate of 200 cubic feet per hour. The carrier gas is a catalytically prepared generator gas containing 20 per cent carbon monoxide, 40 per cent nitrogen, and 40 per cent hydrogen, with a dewpoint of 0 degrees F. or lower.

Since a relatively large quantity of the carrier gas can be used without affecting the carburization, it is employed to maintain a positive pressure in the work chamber. It protects the camshafts from decarburizing gases by preventing the infiltration of air to the work chamber, and also accelerates the purge and flush-out cycles.

As the retort gases are much lighter than the surround-

ing air, due to temperature differential, it is necessary to make the area of exhaust from the chamber small enough to insure a pressure in the retort. The effluent pipe for these furnaces is restricted to obtain a retort pressure corresponding to 0.2 inch of water column. The gases do not burn within the retort, due to the lack of oxygen, but they are ignited as they leave the effluent pipe in the furnace cover.

A water-cooled fan in the bottom of the furnace is belt-driven by a 2-H.P. motor to recirculate the retort atmosphere and pull it through the charge. The fan housing is provided with a gasket, and the furnace cover, when in position, is sealed with asbestos rope to prevent gases capable of causing extraneous and detrimental reactions from entering the chamber. Since carbon dioxide is a potent decarburizer, reacting with carbon in the steel to form carbon monoxide, its percentage in the retort atmosphere is kept as near zero as possible. The atmosphere is periodically sampled in an orsat, mounted on the furnace control board, and the carbon dioxide content is kept below 0.2 per cent.

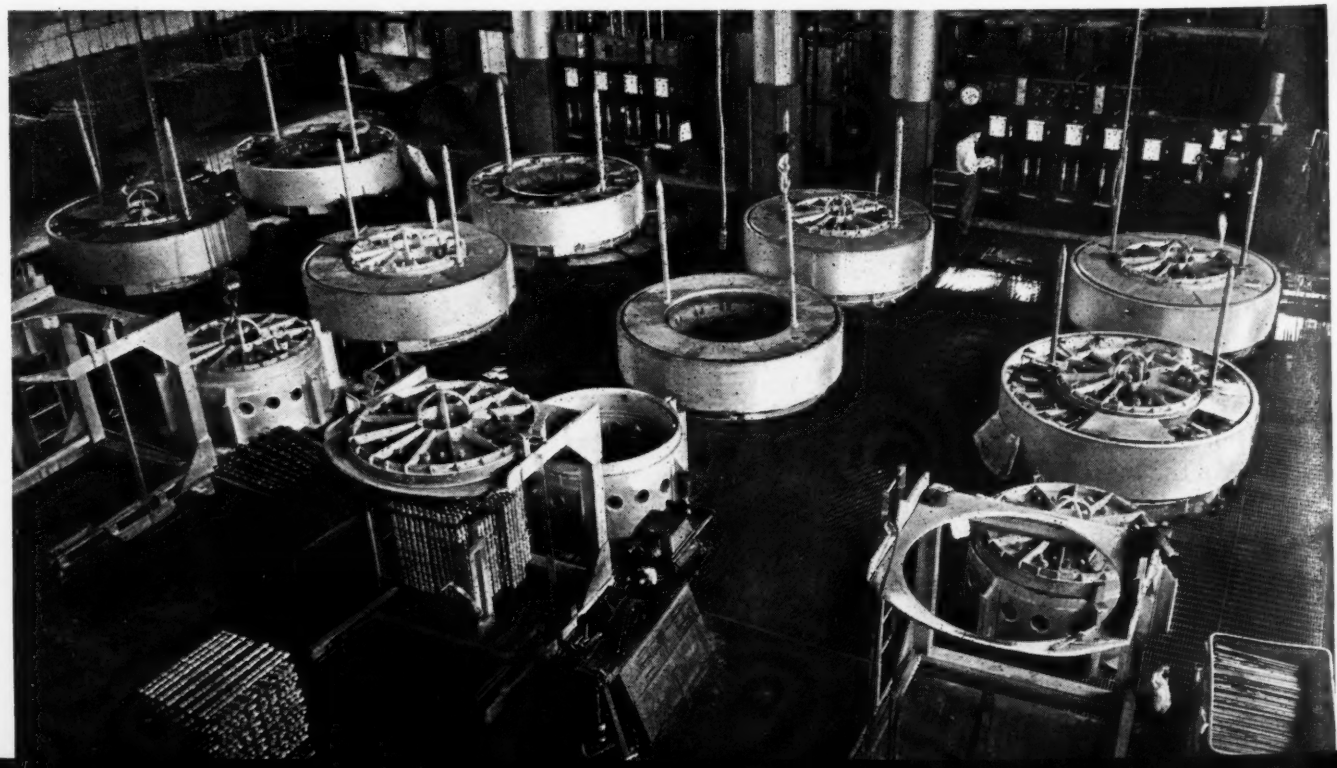
Upon breaking the cover seal to remove the load, as shown in Fig. 9, the retort becomes filled with air. Approximately thirty minutes is required to purge the retort and eliminate the carbon dioxide when a new load has been placed in position. With retort reaction, usually caused by an oxide coating on the walls of the retort, a longer purge time is required.

After approximately five hours to bring the furnace to the carburizing temperature, and ten hours at this temperature, the firing of the radiant tubes is discontinued and the flow of carburizing medium is stopped. The flow of carrier gas, however, is continued during this so-called "diffusion period."

This diffusion period of approximately two hours, during which the temperature of the camshafts decreases to 1500 degrees F., provides an accurate control of the depth of carbon case and the percentage of carbon on the surface of these parts. Part of the surface carbon density of about 1.3 per cent at 1700 degrees F. is diffused inward to the required depth of 0.080 inch until the surface carbon density at 1500 degrees F. is only 1 per cent. Also, this period protects the parts against decarburization while still protected by the carrier gas atmosphere. The possible decarburization at 1500 degrees F. is only one-quarter of that at 1650 degrees F., so that the parts can be transferred to the atmosphere for the remainder of their cooling cycle.

The batch of camshafts, still suspended from the under side of the furnace cover, is carried by the overhead crane to a position over a suction cooler, where they are lowered into the pit, as shown in the heading illustration. This forced

Fig. 8. Battery of Eight Carburizing Furnaces and Four Suction Coolers are Used to Produce a Case 0.080 Inch Deep on Camshafts



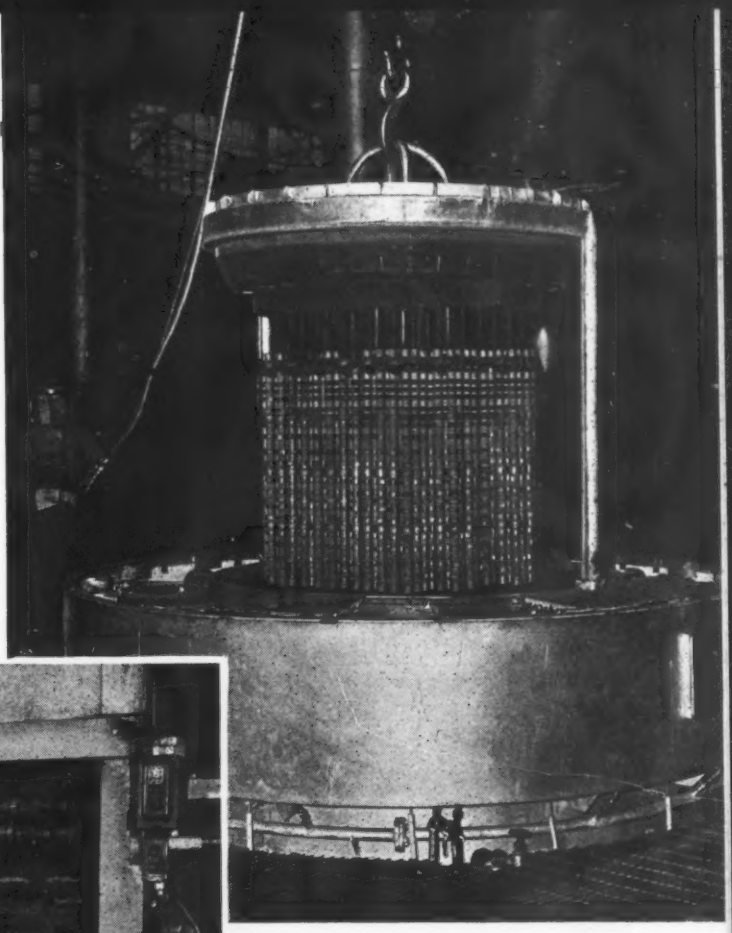


Fig. 9. (Right) Carburizing to a Case Depth of 0.080 Inch has been Completed on this Batch of 256 Camshafts that is being Removed from the Furnace after Approximately Seventeen Hours

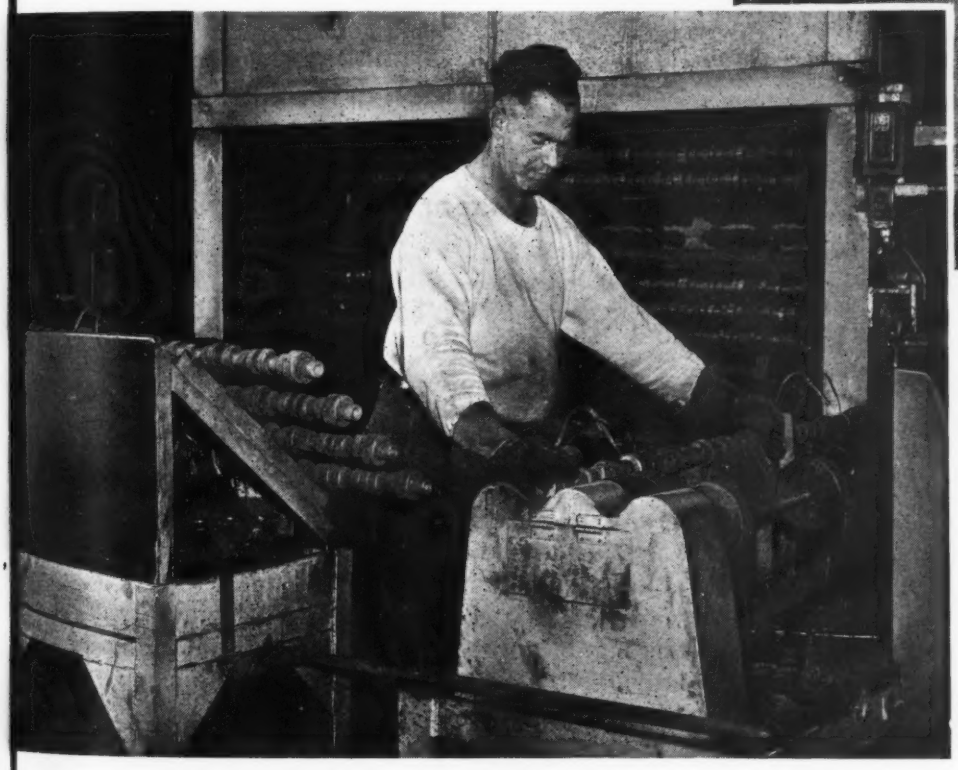


Fig. 10. (Left) The Periphery and Faces of the Distributor Drive Gear Blank Located in the Center of the Camshaft are Flame-annealed to Facilitate the Gear-cutting

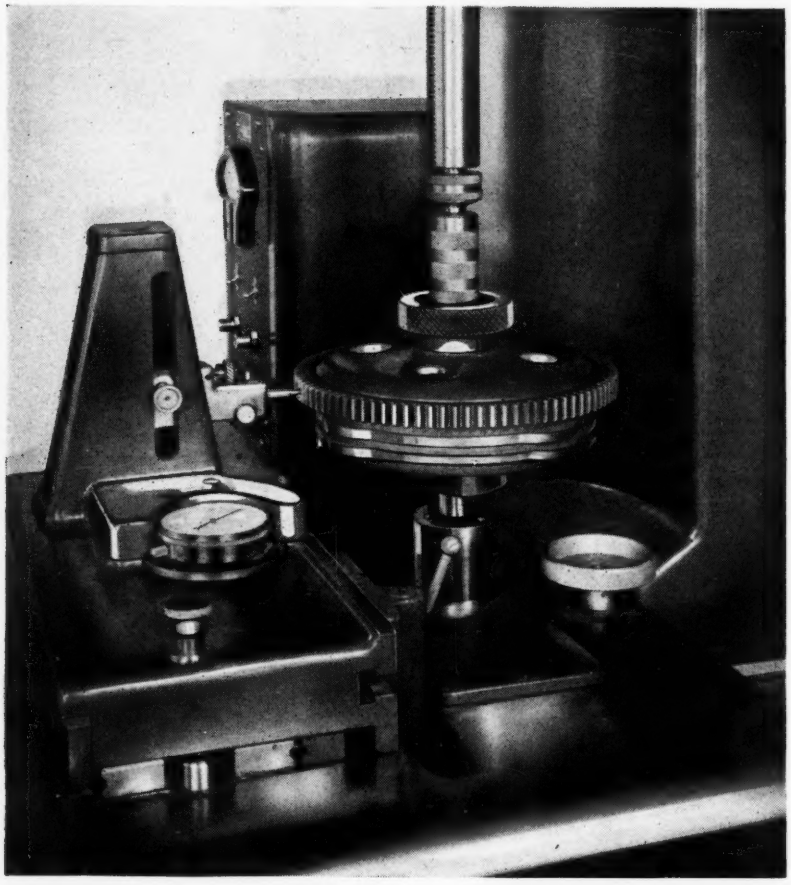
cooling requires approximately two hours per load. The suction fan draws air into the pit and around the work and forces the hot air up exhaust stacks into the atmosphere.

The working surfaces are then hardened by passing the camshafts, on an endless link belt, through an open furnace maintained at 1450 degrees F. The shafts are quenched in brine. This imparts a file hardness, corresponding to Rockwell C-60, to the cam and bearing surfaces. The camshafts are next tempered at 450 degrees F. in a vertical type oven similar to the one previously described.

The periphery and faces of the distributor drive gear blank, located in the center of the camshaft, are then flame-annealed by means of the set-up shown in Fig. 10 to facilitate gear-cutting. A mixture of oxygen and natural gas is used for the flames that heat the gear blank to approximately 1600 degrees F. Water is sprayed on the camshaft on each side of the gear blank to restrict annealing to the desired area.

The camshafts are rotated on this flame-annealing fixture by gear-driven rollers. The shafts are then pickled, teeth are cut on the distributor drive gear, and the bearing and cam surfaces are ground. No further heat-treatment is required, as the gear is left soft.

The Active Portion of Involute



Knowing the Active Portion of Involute Gear Teeth Permits the Use of Profile Recording Machines with Greater Accuracy and with Less Danger of Damage to the Instrument. Method of Determining the Used Portion of the Involute is Developed and Applied to its Measurement in This Article

By SIDNEY CORNELL

In recent years the advent of the recording precision measuring machine for involute profiles and its wide adoption in industry as a means of control for involute gears have brought from obscurity the concept of the active portion of the tooth profile. Formerly, only the gear designer was concerned with what portion of the involute was used. Functional methods of control prevailed, in which the gear being inspected was run with a mating gear or master gear. The working portion of the tooth was automatically subject to control. As functional methods are now supplemented or replaced by the recording involute measuring machine, shown in the heading illustration, knowledge of the active portion of the involute on spur and helical gears has become important to the manufacturer and inspector.

Since the involute measuring machine is not automatically limited to the measurement of the working profile, the operator should be instructed as to the portion of the tooth that is to be measured in regard to involute limits. If the operator has no knowledge of the extent of the involute's active portion, two undesirable results may be obtained: Measuring the unused portion toward the base circle indicates errors that are of no significance and therefore adds to manufacturing difficulties; and may result in damage of the machine pointer.

Basic Principle of the Involute

The reasons for these two difficulties and the avoidance of them by furnishing specifications of the active portion of the profile are best explained by referring to the basic principle of the involute. In Fig. 1 is shown how the "unwinding string" analogy can be applied to the development of an involute. The involute extends without limit from the pulley or base circle, but when applied as a gear-tooth profile, the involute curve is used from the limiting contact point to the outside diameter only. The tooth profile lying between these two points is known as the active portion.

on External Spur and Helical Gears

When the profile is measured on an involute measuring machine, a definite indication is made on the recording paper when the pointer reaches the outside diameter of the gear. No indication is made by the machine at the limiting contact point. Therefore, a definition of the limiting contact point must be given if the operator is to determine involute limits on the active portion of the profile.

Limiting Contact Point

Contact with the mating gear occurs over the entire active profile. The limiting contact point is the point of contact with the outside diameter of the mating gear, Fig. 2. Line T_1T_2 may be thought of as a string similar to that in Fig. 1. However, in this case, the string is attached to two pulleys or base circles, and as it unwinds from one, it winds on the other. Point P represents the pencil in Fig. 2, and generates the involutes of both gears simultaneously. For this reason, the line T_1T_2, which is the path of point P, represents the path of the contact points between the two involutes.

The outside diameter of the small gear intersects line T_1T_2 at m, which is the point where contact between the gears stops. For this reason, point m is called the limiting contact point on the large gear. R_1 is the distance from the center of the gear to the limiting point of contact, and is called the limiting contact radius. The involute profile between the outside diameter and R_1 is the active portion of the gear, and the portion that must be controlled during manufacture. Usually an arbitrary amount is subtracted from the computed value of limiting contact radius for clearance.

It is possible, of course, for R_1 to be equal to a_1, the base circle radius, but this is unusual. R_1 is never smaller than a_1 as the involute does not exist inside the base circle. If the outside diameter of a mating gear contacts the base circle ($R_1 = a_1$), and the outside diameter of the mating gear is then increased by an arbitrary amount, a condition known as "involute interference" results.

This is shown in Fig. 2 on the small gear. The outside diameter of the large gear does not intersect line T_1T_2. Pencil P would have to travel along the base circle beyond point T_2 to reach this outside diameter and would not produce an involute in that area. This condition results in rough action between the gears, and indicates poor design. When involute interference exists, the design should be changed. If such a change is not practical, R_2 should be specified as equal to a_2, and a minimum amount of under-cut called for to reduce the rough action.

The designer tries to keep the contact away from the base circle, because the portion of involute near the base circle is difficult to manufacture. This portion has a rapidly changing radius of curvature, and is subject to the effects of blending with the fillet radius. Thus, the limiting contact radius R should be somewhat larger than the base circle radius a.

From a manufacturing point of view, the ad-

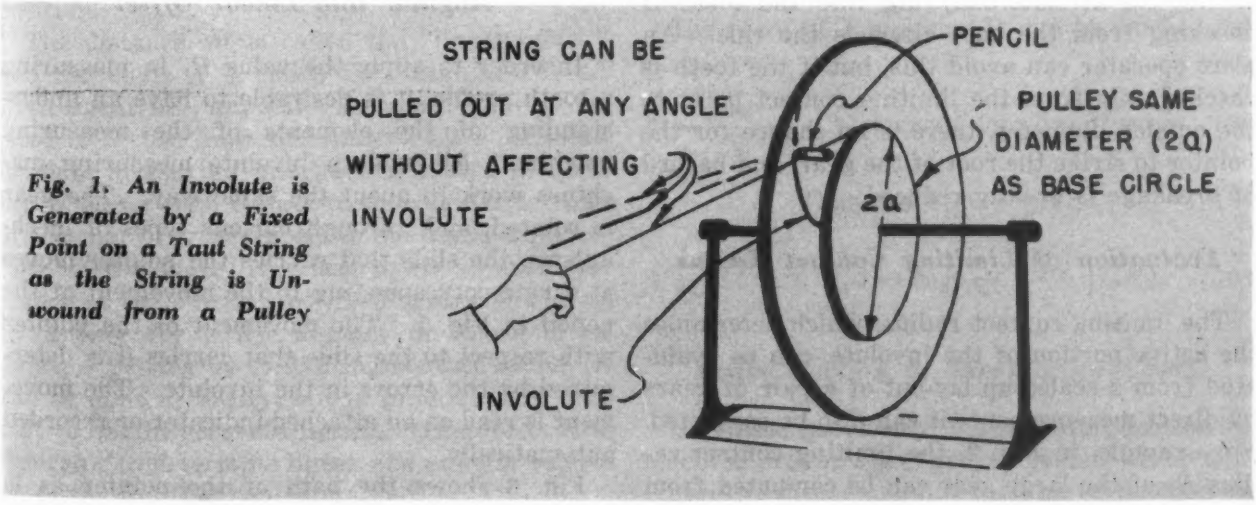


Fig. 1. An Involute is Generated by a Fixed Point on a Taut String as the String is Unwound from a Pulley

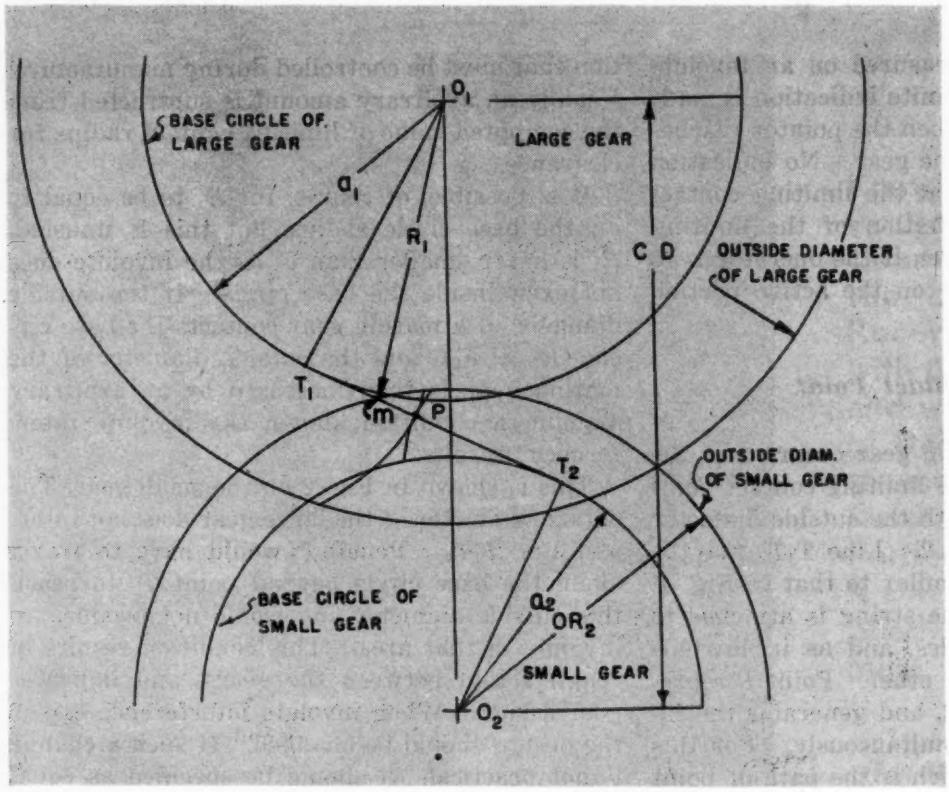


Fig. 2. Diagram of a Pair of Mating Gears, Showing the Path T_1T_2 of the Contact Points between the Two Involutes and the Limiting Contact Point m

vantages of well designed gears are to be realized only if the hard-to-manufacture portion near the base circle is not subject to rigid involute tolerances. Therefore, the involute measuring machine operator must have knowledge of the limiting contact point of the gear.

A secondary advantage resulting from the specification of the limiting contact point is the avoidance of broken pointers on the measuring machine. When the root diameter of a gear is larger than the base circle, the pointer that traces the involute may dig into the tooth if checking from the base circle is the rule. An alert operator can avoid this, but if the tooth is checked only from the limiting contact point to the outside diameter, there is no chance for the pointer to strike the root of the gear, and hazard of breakage is greatly reduced.

Evaluation of Limiting Contact Radius

The limiting contact radius, which determines the active portion of the involute, can be evaluated from a scaled-up lay-out of a pair of gears by direct measurement; it can also be computed. For example, in Fig. 2, the limiting contact radius R_1 of the large gear can be computed from known values of CD, a_1a_2, and OR_2 by the following procedure:

$$T_1T_2 = \sqrt{(CD)^2 - (a_1 + a_2)^2} \quad (1)$$

$$T_2m = \sqrt{(OR_2)^2 - (a_2)^2} \quad (2)$$

$$T_1m = T_1T_2 - T_2m \quad (3)$$

$$R_1 = \sqrt{(T_1m)^2 + (a_1)^2} \quad (4)$$

There are other methods of determining R_1 or its angular equivalent, but it is not the purpose of this article to discuss them.

Angular and Linear Offset

In order to apply the value R_1 in measuring a tooth profile, it is desirable to have an understanding of the elements of the measuring machine. All modern involute measuring machines work in about the same way. The gear is rotated, and, through various types of mechanisms, the slide that carries the pointer moves at a rate corresponding to the movement of the pencil in Fig. 1. The movement of the pointer with respect to the slide that carries it is determined by the errors in the involute. The movement is read on an attached indicator or recorded automatically.

Fig. 3 shows the path of the pointer as it

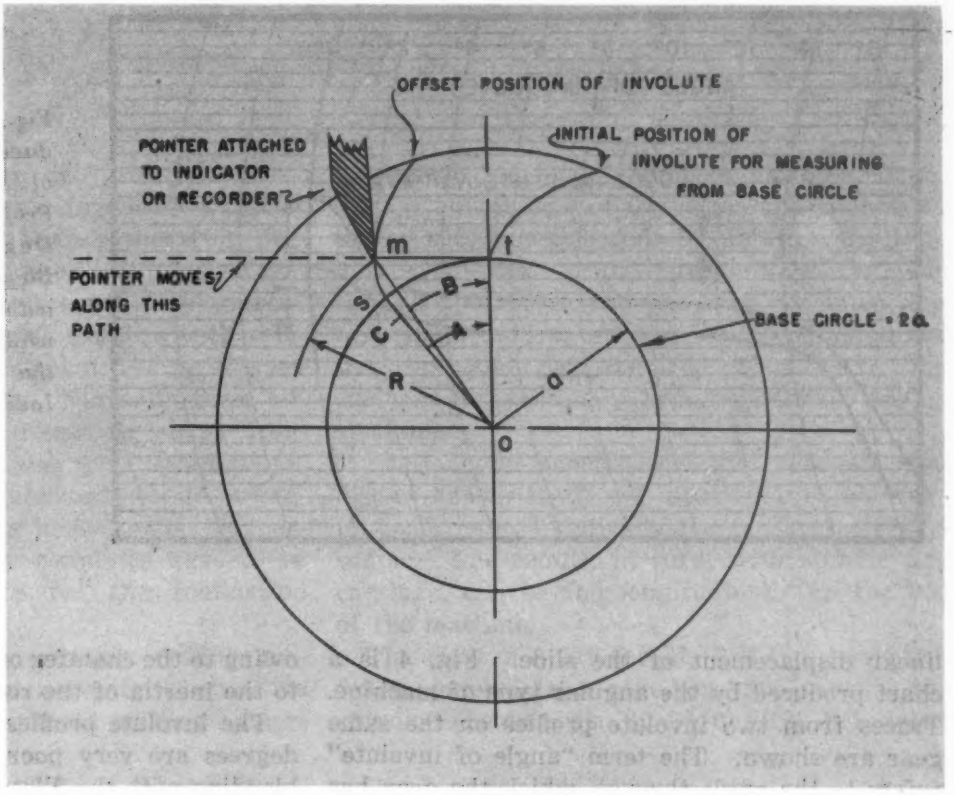


Fig. 3. Measuring Machine Set-up, Showing Path of Pointer as it Traces Involute. Either Linear or Angular Offset Values Can be Used in Setting Machine

traces an involute. If point m is the limiting contact point, then the set-up as shown represents the starting point of measurement. R is the limiting contact radius, and sm is the unused portion of the involute toward the base circle, of which no measurement is to be made. To have the pointer contact the involute at radius R, and not below, the slide is moved so that the pointer is offset from the central position t by the distance mt. This corresponds to an angular movement A of the gear from the initial position.

The distance mt is called the "linear offset," and the angle A is called the "angular offset." Both linear and angular offsets are directly related to R, the limiting contact radius. Modern involute measuring instruments record involute errors either with respect to the angular turning of the gear or with respect to the linear displacement of the slide. It is best to set up such machines at the starting point of measurement m, by setting for either angular or linear offset values. Setting up to limiting contact radius R_1 can be done in theory, but in practice it is difficult to obtain accurate results. Therefore, it is desirable to determine linear and angular offsets from the limiting contact radius.

Referring to Fig. 3, the linear offset mt can be computed from Equations (5) and (6), and the angular offset A from Equations (5) and (7), as follows:

$$\text{Cos } B = \frac{a}{R} \qquad (5)$$

$$R \sin B = mt \qquad (6)$$

$$\left(\frac{180}{\pi}\right) \tan B = A \text{ degrees} \qquad (7)$$

The proof of Equation (7) can be worked out as follows:

$$A = \frac{mt}{a} \times 180 \text{ degrees, by ratio of areas} \qquad (8)$$

$$\text{Then } \tan B = \frac{mt}{a} \qquad (9)$$

$$A = \frac{a \tan B}{a} \times 180 \text{ deg.} = \left(\frac{180}{\pi}\right) \tan B \qquad (10)$$

Active Portion of Involute on Charts

As stated previously, the recording measuring machine produces a chart of involute error with respect to either angular turning of the gear or

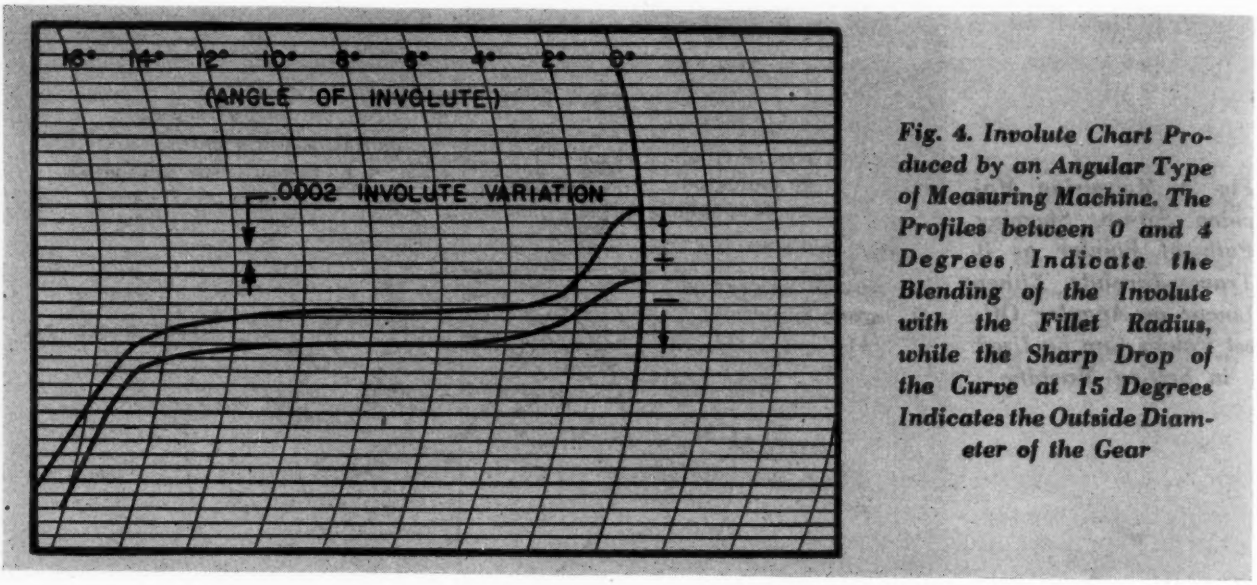


Fig. 4. Involute Chart Produced by an Angular Type of Measuring Machine. The Profiles between 0 and 4 Degrees Indicate the Blending of the Involute with the Fillet Radius, while the Sharp Drop of the Curve at 15 Degrees Indicates the Outside Diameter of the Gear

linear displacement of the slide. Fig. 4 is a chart produced by the angular type of machine. Traces from two involute profiles on the same gear are shown. The term "angle of involute" refers to the angle through which the gear has turned with respect to a measurement started at the base circle. As this chart shows a trace from 0 degree angle of involute, measurement of the profile started at the base circle. At an angle of about 15 degrees, a sharp drop occurs, indicating the outside diameter of the gear. This drop is not as abrupt as might be expected, owing to the chamfer on the end of the tooth and to the inertia of the recording pen.

The involute profiles between 0 degree and 4 degrees are very poor, indicating the effect of blending with the fillet radius. If Equation (10) works out to 4 degrees, then the active portions of the involutes from 4 degrees to 15 degrees are fairly good. Ordinarily, if an offset of 4 degrees is called for, measurement should be started at the 4-degree point, in order to prevent the irregularities between 0 and 4 degrees from showing on the chart.

Electrons Provide Means of Analyzing Metal Surfaces

THE use of a stream of electrons to study the atomic structure of metals and gases and to identify invisible layers or films of foreign materials on metal surfaces has been developed into a practical process in the chemistry laboratories of the University of Michigan. This provides an "electron diffration" method of analyzing metal surfaces which permits a wide variety of practical applications in the fields of welding, lubricating, electroplating, and painting. A machine based on an experimental model developed by Professor Lawrence O. Brockway is now on the market for this purpose.

This machine produces a stream of 40,000-volt electrons in a vacuum chamber. In the center of the chamber is a specimen holder on which the piece of metal to be studied is placed. This metal interrupts the electron stream so that the electrons bend or break off into new paths. As they do so, they expose a photographic plate that is inserted at the end of the chamber.

Every metal breaks up the electron stream in a distinct pattern so that photographs resulting from this process are different for each metal. It is, therefore, possible to identify unknown substances in the electron stream by comparing their "diffraction patterns" or photographs with those of substances already identified.

Portable Milling Machine Decreases "Down Time" of Generators

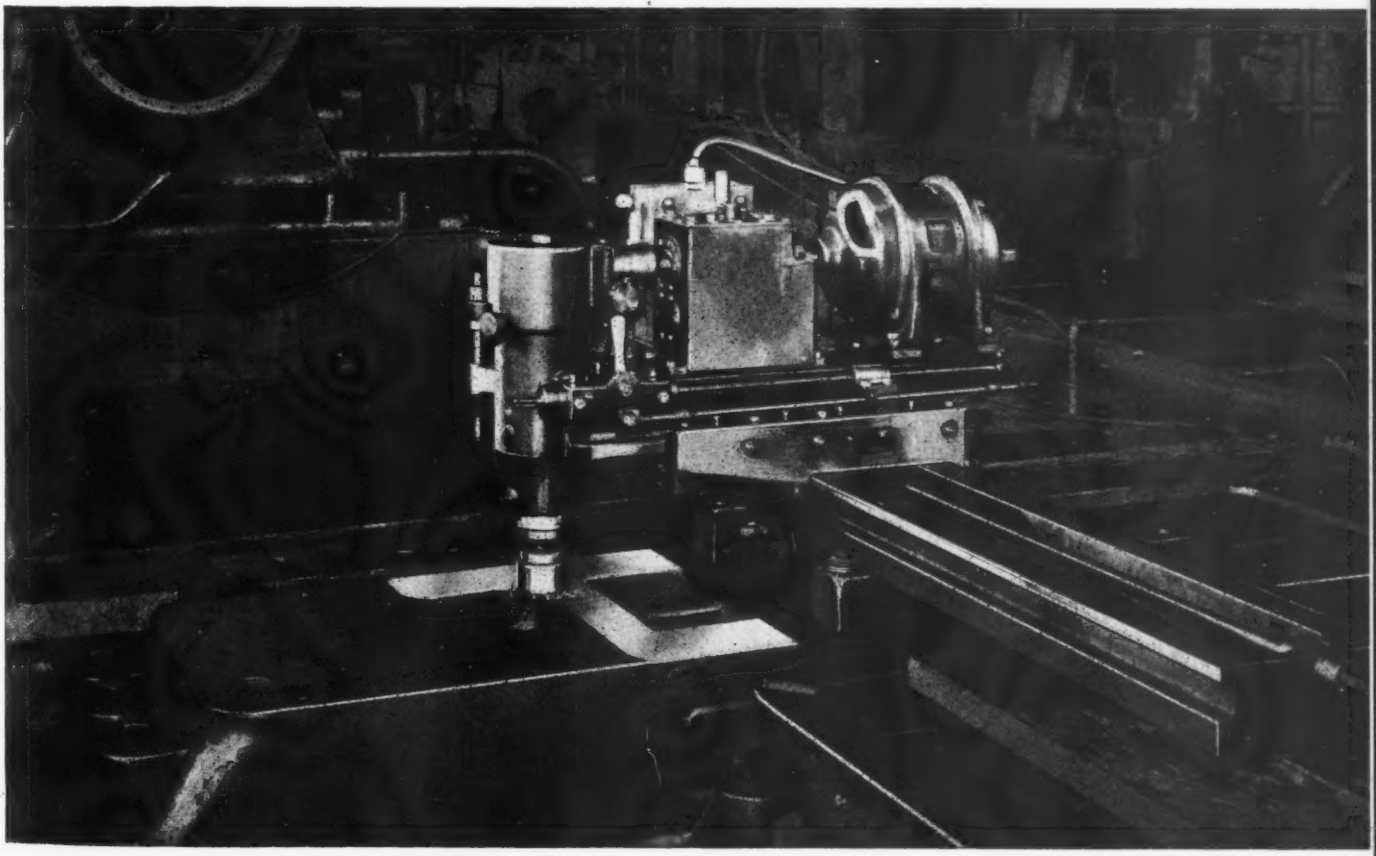
A PECULIAR condition of "growth" or expansion of the concrete foundations in the turbine room at the Hell Gate Generating Station of the Consolidated Edison Co. of New York, Inc., makes necessary the frequent realignment of the generators and shaft exciters with relation to the turbines, the latter not being affected by the foundation growth. Normally these adjustments are made by removing shims from between the generators and their foundations. However, when such adjustments result in generator air gap variations in excess of the permissible 10 per cent, the bedplates have to be machined to compensate for the foundation growth.

Conventional sizes of portable milling machines are of insufficient capacity to machine large bedplate surfaces without making numerous set-ups. A portable milling machine having a longitudinal feed of 60 inches and capable of taking cuts 1/4 inch deep in cast iron has been built by the maintenance group of this company for this specific use. It has been estimated that this special milling machine has saved one-third the time and cost required when using two smaller, conventional type, portable milling machines.

The machine consists of a motor-driven spindle, as shown in Fig. 1, secured to a carriage that can be automatically fed transversely in a saddle. The saddle, in turn, with spindle and carriage, can be fed longitudinally on the bed of the machine.

The shaft of a 720-R.P.M., 2-H.P. electric motor is coupled to a gear-box that permits the spindle to be driven at 36, 53, or 72 R.P.M. Selec-

Fig. 1. Portable Milling Machine having a Longitudinal Feed of 60 Inches and a Transverse Feed of 34 Inches which Permits Machining Large Surfaces with a Minimum of Set-ups



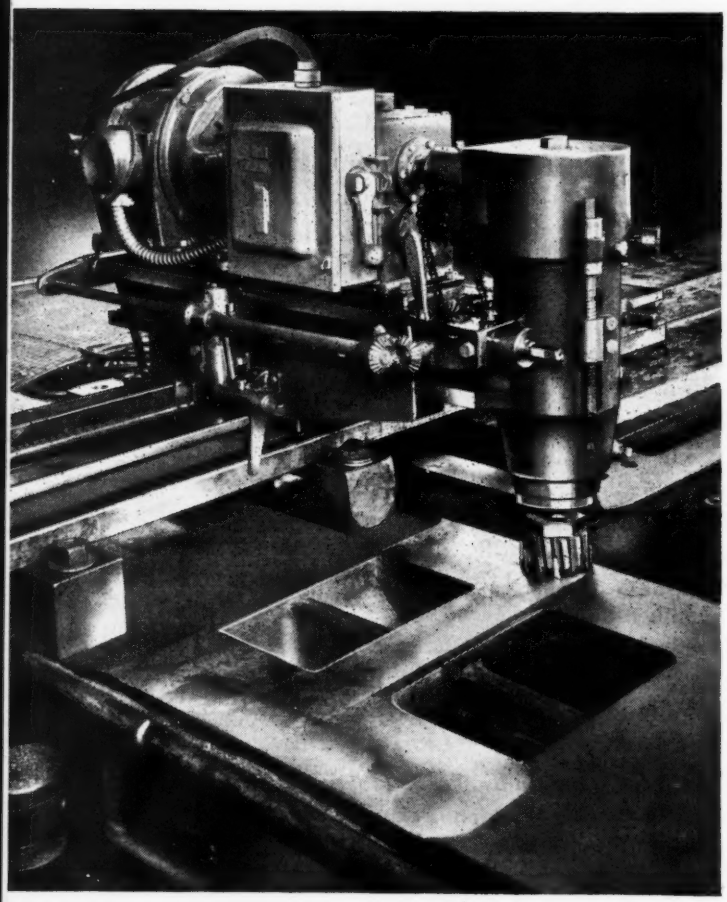


Fig. 2. The Portable Milling Machine Shown in Fig. 1 is Placed on Parallel Bars and Clamped to the Bedplate Surface that is to be Milled

tion of speed is made by a hand-operated lever mounted on top of the gear-box. The spindle of the milling machine, which was machined and ground from a solid 8-inch diameter steel shaft and mounted on ball bearings, is keyed to an internal spline in the driven gear, thus permitting vertical adjustments up to a maximum of 5 inches. The vertical position of the spindle is set for a certain depth of cut, usually 1/4 inch for roughing and 1/16 inch for finishing, and the spindle is locked in this position during the milling operation.

A chain, which is turned by a sprocket geared to the spindle-driving shaft, drives jaw clutches that are engaged with bevel gears to operate the longitudinal or transverse feeds. A chain is used instead of gear or direct drives to the feed mechanisms as a safety measure in case hardened spots are encountered in the cast iron being milled. A non-adjustable feed rate of 0.014 inch per revolution is available for both transverse and longitudinal feed. The transverse feed is limited to 34 inches, and the longitudinal feed to 60 inches.

A face-milling cutter employing twelve high-speed steel cutter blades is used on the milling machine. The machine is placed on parallel bars and clamped to the surface to be milled, as shown in Fig. 2.

The saddle was the only part of the machine cast. The carriage, to which the motor and gear-box are bolted and the spindle is welded, was made from 5/8-inch thick boiler plate. The bed of the machine consists of two 3- by 5-inch steel bars joined by welding five 2-inch square steel cross-bridges to them. The machine cost about $2700 to build, including parts and labor.

* * *

Labor and Human Relations Present a Leadership Challenge to Big Business

In an address recently made by Ernest R. Breech, director and executive vice-president of the Ford Motor Co., Mr. Breech discussed at considerable length the challenge to leadership of big business offered in the field of labor and public relations. Mr. Breech said, "In the transition from smaller business to bigger business, management lost touch with people. Organized labor stepped into the gap and has done a great deal to achieve economic and other tangible advantages for the wage-earner. But what organized labor did, perhaps more than anything else, was to give the worker a new focus, a new purpose, a new cause. Organized labor is not simply an economic thing—it is a social thing. Men and women are often proud of their unions and take comfort in the vision of better things which they see in the programs and purposes of their unions."

Mr. Breech continued, "To meet the challenge of mass production and mass distribution through mass organizations, we must develop mass leadership. The real problem which we face is to make the free-enterprise system fit the new needs which have been created by its own magnificent growth. What we need is some modernizing—and the men who, for my money, can do the best job of modernizing along this line are the men who helped to build big business in the first place."

1947 Depends Upon a Solution of Labor-Management Problems

PROSPERITY in the coming year depends largely upon an equitable solution of the difficulties that have separated labor and management so widely since the close of the war. Some gloomy economists have predicted a business recession in the not-too-distant future, but why should there be such a recession when there are 58,000,000 people gainfully employed and there exists a tremendous backlog demand for the consumer products that could not be purchased during the war years? Over 1,300,000 applications for building priorities alone have had to be temporarily denied. These applications for the most part were for investments of over $15,000 each. With such potential business on hand, there is an opportunity for unprecedented prosperity if labor and management do not fumble the ball. That would be tragic!

As work stoppages result in reduced prosperity for all, it behooves leaders of labor and business to exert the utmost efforts to find a satisfactory solution of their difficulties. Nothing is to be gained by presuming that either business or labor is always completely at fault, and this fact has been recognized by outstanding business executives. Labor leaders must show a similar spirit of conciliation and realize that public interests must eventually be placed above personal considerations.

In view of the unfavorable public opinion aroused by the recent coal strike and the likelihood of Congressional action toward a modification of labor legislation, labor leaders should be more anxious to cooperate than in the past. Unless labor leaders take a more reasonable attitude, the labor legislation to be enacted by the new Congress may go too far to the right. Besides, the rank-and-file union men may soon wake up to the fact that years of work are required to recoup the financial losses of serious strikes, and refuse to follow blindly the dictates of radical leaders.

Astute business men are beginning to understand some of the shortcomings of management in the past and to advocate extending their public relation activities to their own employes. Workers are inclined to think that the stockholders get too large a share of the profits; yet, in a recent survey, when workers were asked what return they would expect if they invested $5000 in a company, the replies ranged from 5 to 15 per cent in annual dividends. Earnings today from stocks and bonds average well below the minimum figure. It would promote understanding between workers and management if concerns would tell their workers more about financial policies.

Progressive business executives know that the future of the private-enterprise system in this country depends on a spirit of give-and-take in industrial relations, and that a preponderance of dictation either by management or labor will not work for long. Leaders of labor, too, must realize that industrial prosperity cannot be wrecked without damage to the welfare of labor, as well as to management and the public. With their honest cooperation in helping industry return to efficient productivity, there is every reason to anticipate a prosperous 1947 for labor, business, and the general public.

Charles O. Herb

New Aluminum-Oxide Abrasive

Grinding Wheels Made of a New Fused Aluminum Abrasive (32 Alundum) have been Developed Primarily for Machining High Tensile-Strength Steels, but are also Effective on Such Materials as Cast Iron, High Alloy Steels, and Some Low Tensile-Strength Metals

By GORDON T. RIDEOUT
Norton Co., Worcester, Mass.

IN their search for better abrasives, engineers have held two requirements paramount—resistance of grain to point dulling and ability of grain to fracture under grinding pressures before serious dulling occurs. With these two conditions satisfied, a grinding wheel can cut even the toughest alloy steels, and wears slowly, but sufficiently to always present a sharp cutting edge to the work. Of the manufactured abrasives, the best up to the present has been high in quality as regards only one of these requirements and somewhat lower as regards the other.

A recent development of the Norton Co., known as "32 Alundum," gives promise of fulfilling both requirements. Produced for all types of light and heavy commercial grinding on high tensile-strength steels—carbon steels and tool steels—it speeds up grinding operations; is resistant to wear, and therefore lasts longer and requires fewer dressings; and cuts cooler than previous abrasives. In addition to its usefulness for grinding steel, this abrasive also has proved effective in some applications on cast iron, 18-8 stainless steels, chromium plate, Stellite, Rexalloy, aluminum, and hard rubber, and, in a few instances, on tungsten carbide.

32 Alundum abrasive is approximately 99.6 per cent aluminum oxide. While one other abrasive has approached this state of purity, it has contained a large number of pores in its crystalline structure and has been composed of from 4 to 6 per cent beta alumina, a soft sodium aluminate material. These properties decreased cutting efficiency. Almost all of the new abrasive is alpha, or hard, alumina. Its impurities are titanium and silicon oxides. Far from lessening hardness, these impurities serve a vital function —they are distributed in thin films throughout the grains, so that when high pressure is exerted against a dull face on a grit, the grain fractures and exposes a sharp point. This means a better and cooler cutting action, since the wheel does not tend to glaze.

There is another factor that adds to the cutting efficiency of the abrasive. Its grains are not crushed during manufacture, but rather are crystallized by cooling a fluid bath of bauxite to which has been added a metal sulphide. At the higher temperatures, the crystals begin to grow, and they reach maximum size before the impurities start to solidify. Hence, when the furnace charge has hardened, the impurities encircle the crystals in a decomposable matrix. The solidified ingot then is separated into large lumps

Improves Grinding Efficiency

and exposed to water, which dissolves the sulphide boundaries and releases grains of pure aluminum oxide.

Once loosened by this slaking process, the particles need only be dried, screened, and made into wheels. Fortunately, the furnace phase of the operation is subject to some control, and the resultant grains are distributed over a commercial size range of from 16 to 100.

A photomicrograph of several grains made by the sulphide process is shown in Fig. 1. Since no crushing action was necessary to bring them to final size, the crystals are rough and sharp; each crystal has a strong, solid shape and many pointed nubs. When they are embedded in a grinding wheel, one or more sharp points are exposed. Contrast these grains with those of an ordinary white aluminous abrasive shown in Fig. 2. The latter grains have been crushed to size, and as a result, have smooth faces and continuous edges; when they are embedded in the surface of a grinding wheel, they may or may not present a sharp edge to the work.

The effect of the many re-entrant angles on a grain of 32 Alundum is threefold: They penetrate deeper into the work, improve cutting, and cause less heat to be generated. In these actions, they are no different than any single-point tool. However, while production is increased, this cutting action sometimes leaves noticeably coarser grain marks on the work surface. This can be overcome by using a wheel one grit size finer. On some materials, however, the finish is the same as or better than that obtained with ordinary abrasives because of the freedom from "plowing" of the metal.

Available only in 100 grit and coarser, the new abrasive is not applicable for honing sticks and fine polishing wheels, or for such operations as grinding ball bearings or glass. While not suitable for the finish-grinding of rolls, it can be used for rough-machining steel or hard rubber rolls. On occasion, the finish of a piece can be improved by diminishing the feed, sparking out, or specifying a finer grit size than that previously used on grinding wheels. Also, since the sharper grains penetrate the work more easily, it sometimes is necessary to use more bond to

Fig. 1. Since Grains of 32 Alundum are Crystallized by Cooling a Fluid Matrix, They are in a Natural Crystalline State and have a Surface Consisting of Many Pointed Nubs or Cutting Edges. Regardless of how a Particle is Embedded in a Wheel, a Sharp Edge Always is Presented to the Work

Fig. 2. After being Produced in an Electric Furnace, Ordinary Abrasives Must be Crushed to Size. This Operation Leaves Smooth Faces and Continuous Edges on the Grain—a Condition that, when Multiplied by the Thousands of Grains on the Surface of a Wheel, Makes for Less Cutting Efficiency

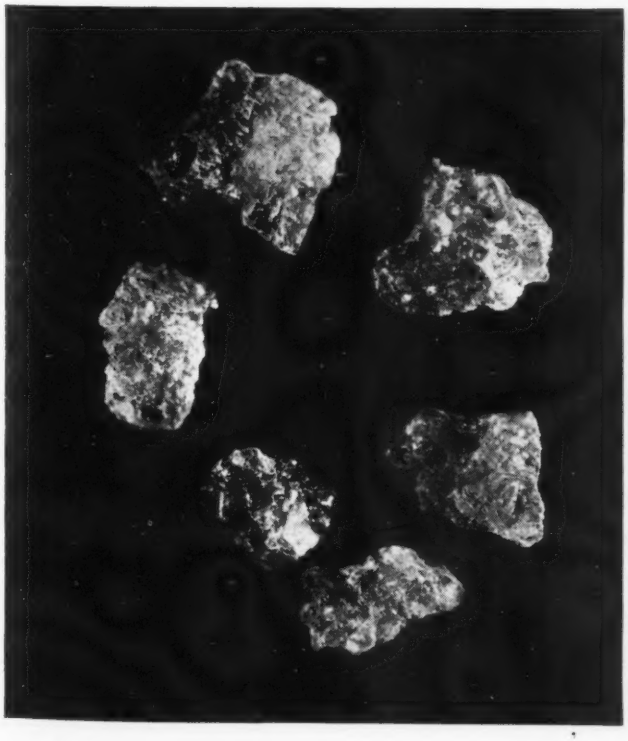


Table 1. Type of 32 Alundum Wheels that have Proved Satisfactory for Specific Grinding Jobs

General Type of Grinding Operation	Type of Work	Material	Wheel Specifications (Grinding Wheel Manufacturers' Associaton Standard Marking)	Size of Wheel, Inches
Surface Grinding In converting, specify same grade and grit size as wheel now in use or use table as guide for selection.	Plate	Cast Iron	32A46-H8VBE	20 × 3 × 8
	Gear-case Cover	Cast Iron	32A30-F12VBEP	Segment, Vertical-spindle Grinder
	Draw Die	Carbide and Steel	32A46-H8VBE 32A46-I8VBE	7 × ½ × 1¼
	Die	Air-hardened Chromium Steel	32A60-H8VBE	.....
	Machine Parts	Open-hearth Steel	32A24-G8VBE	Segment, Vertical-spindle Grinder
	Bars	Stellite and Colmonoy	32A36-G8VBE	Segment, Vertical-spindle Grinder
	Die	High-carbon, High-chromium Steel	32A46-G8VBE	12 × 2 × 5
	.....	Die Steel	32A30-I8VBE	8 × 3 × 5½ ME 18051
Tool Grinding In converting, specify same grade and grit size as wheel now in use or use table as guide for selection.	Chaser	High-speed Steel	32A60-M5VBE	10 × ½ × 3
	Staggered-tooth Cutter	High-speed Steel	32A46-K5VBE	3–2¼ × 1¼ × ½ ME 21560
	Staggered-tooth Cutter	High-speed Steel	32A46-K5VBE	6 × ½ × ½ ME 19229
	Milling Cutter	High-speed Steel or Rexalloy	32A60-K5VBE	5 × 1½ × ½ ME 19243
	Milling Cutter	Stellite	32A46-K5VBE	3¼–2⅛ × 1¼ × ½
	Rotary Gear Cutter	Tool Steel	32A60-I12VBEP	10 × 1 × 1¼ ME 9801
	End-mill	High-speed Steel	32A60-I8VBE	6 × ½ × ½ ME 19299
	End-mill	High-speed Steel	32A60-J8VBE	5 × 1½ × 1¼ ME 19243
	End-mill	High-speed Steel	32A60-K5VBE	3–2¼ × 1¼ × ½ ME 21560
	Hob	High-speed Steel	32A60-J5VBE	10 × ⅝ × 1 B face
	Hob	High-speed Steel	32A60-J12VBEP	8 × ¾ × ¾ ME 12608
	Gear Hob	High-speed Steel	32A46-K5VBE	7 × ⅝ × ¾ ME 12608
	Reamer	High-speed Steel and Molybdenum	32A54-K5VBE	8 × ½ × 1½
	Backing-off Reamer	High-speed Steel	32A80-L8B5	3 × 1½ × ⅝ ⅜R–⅜B
	Off-hand Drill	High-speed Steel	32A46-M5VBE	7 × 1¼ × ⅞
	Covel Pointing Drill	High-speed Steel	32A54-O7VBE	10 × 1½ × 1 R1/S 5½ × 1
	Backing-off Drill	High-speed Steel	32A80-K6VBE	8 × ⅜ × ½
	Sellers Drill	High-speed Steel	32A80-J5VBE	5 × 1½ × 1½ R1/S 3½ × 1
	Tool Bit	Stellite	32A46-J5VBE	4–3 × 1½ × ¾ ME 19237
	Broach	High-speed Steel	32A80-G12VBEP	8 × 1 × 1¼
Internal Grinding In converting, specify same grade but one grit size finer than wheel now in use or use table as guide for selection.	Gear	Hardened Steel	32A60-K5VBE	2¼ × 1¼ × ⅞
	Die	Die Steel	32A60-J5VBE 32A60-J8VBE	.....
	Liner	Hardened Steel	32A60-J5VBE	1¼ × 1½ × ⅜
	Plate	Stainless Steel	32A801-N8VBE	⅜ × ⅜ × ¼
	.....	Hardened Steel	32A70-L5VBE	.....
	General Purpose	Carbon Steel	32A60-K5VBE	.....

Table 1. (Continued) Type of 32 Alundum Wheels that have Proved Satisfactory for Specific Grinding Jobs

General Type of Grinding Operation	Type of Work	Material	Wheel Specifications (Grinding Wheel Manufacturers' Associaton Standard Marking)	Size of Wheel, Inches
Centerless Grinding In converting, specify one or two grades harder and same grit size as wheel now in use or use table as guide for selection.	Roughing	Hardened Steel	32A60-M5VBE 32A60-N6VBE	.....
	Roughing	Soft Steel	32A54-N5VBE 32A60-N6VBE	.....
	Finishing	Hardened Steel	32A80-O7VBE 32A1001-O7VBE	.....
	Finishing	Soft Steel	32A80-O7VBE 32A1001-O7VBE	.....
	Outer Ball-bearing Rolls	S A E 52100 Steel	32A60-M5VBE	20 × 4 × 12
	Pins	Hard and Soft Steel	32A60-N6VBE	24 × 4 × 12
Cylindrical Grinding (Between Centers) In converting, specify one grade harder and same grit size as wheel now in use or use table as guide for selection.	Plugs	Chromium-plated Steel	32A701-L5VBE	20 × 1½ × 5
	.....	High-carbon, High-Chromium Steel	32A60-J5VBE	.....
	Shafts	Hardened Steel	32A80-N6VBE	14 × 1 × 5
	Refrigerator Parts	S A E 1020 Steel	32A80-N6VBE	.....
Snagging In converting, specify one grade harder and same grit size if 16 or finer for vitrified wheels, two grades harder and same grit size if resinoid wheel, or use table as guide for selection.	Off-hand Tool Grinding	Tool Steel	32A24-Q5B5 32A36-O5VBE	16 × 1 × 8 12 × 2 × 1½
	Swing-frame Grinding	Cast-steel Blocks	32A161-R4B7	18 × 3 × 8
	Floor-stand Grinding	Gray-iron Castings	32A161-R4B7	30 × 2 × 12
	Floor-stand Grinding	Steel Castings	32A161-R4B7 32A16-P4B5	20 × 2½ × 8
	Floor-stand Grinding	Malleable-iron Castings	32A20-Q4B5 32A161-Q5VBE	20 × 1½ × 12 24 × 1½ × 2
	Portable Grinding	Stainless-steel Plate Welds	32A161-Q5B5 32A161-R5B5	8 × 1 × ⅝
	Portable Grinding	Steel-plate Welds	32A161-R5B7	8 × 1 × ⅝
	Portable Grinding	Steel Castings	32A161-P4B5	8 × 1 × ⅝
	Floor-stand Grinding	Nickel-chromium Steel Forgings	32A36-O5VBE	14 × 1½ × 1½
Crankshaft Grinding In converting, specify same grade and grit size as wheel now in use or use table as guide for selection.	Crankshaft	Steel	32A46-N5VA	42 × 1.799 × 12
Roll Grinding In converting, specify two grades harder and same grit size as wheel now in use or use table as guide for selection.	Rolls from 6 inches to 18 inches in diameter and from 48 inches to 60 inches long	Steel and Cast Iron	32A46-L5VBE	24 × 3 × 8
Cam Grinding In converting, specify two or three grades harder and one grit size finer than wheel now in use or use table as guide for selection.	Cam	Steel	32A70-O8B2	.....

Table 2. Grain Sizes, Hardness Grades, and Wheel Structures of 32 Alundum Grinding Wheels

Grain Size			Hardness Grade			Wheel Structure			
Coarse	Medium	Fine				Close	Medium		Wide
16	30	70	F	K	P	0	4	7	11
20	36	80	G	L	Q	1	5	8	12
24	46	90	H	M	R	2	6	9	
	54	100	I	N	S	3		10	
	60		J	O	T				
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hold them in place; the bond varies from 0 to 3 grades harder than on ordinary wheels, depending on the operation. Some general recommendations for conversion to 32 Alundum wheels are given in Table 1; these are for average conditions, and should serve only as a basis for further investigation.

As previously mentioned, grain sizes of this abrasive range from 16 to 100. Hardness grades of bond vary from F to U. The material is available in vitrified Type BE wheels and in all grades of resinoid-bonded wheels, but not in rubber, shellac, silicate, or magnesite. In addition, a special vitrified bond—Type A—is available in crankshaft wheels. Table 2 shows the range of grain sizes, grades, and structures of these wheels, although not all sizes of wheels are stocked, nor are all bonds in any given size.

Markings for Norton wheels follow the standard practice of the Grinding Wheel Manufacturers' Association: The first designation represents type of wheel, in this case 32A; the grain size is specified next; and following in order come hardness grade, type of wheel structure (open or closed), kind of bond, and classification of bond. A wheel marked 32A46-H8VBE refers to 32 Alundum of grain size 46 and hardness grade H; the numeral 8 designates the wheel structure number, while V is the bond (vitrified), and BE the bond type.

Examples of Grinding Operations with Wheels of the New Abrasive

Since surface grinding constitutes the majority of all grinding applications, it might be well to examine a few case histories involving the use of wheels made of the new abrasive. It already has been pointed out that a 32A wheel cuts freer, requires less dressing, and in many cases has shown a substantial increase in life over other wheels.

The increase in life can be attributed not only to the hardness of the abrasive, but, also, indirectly, to its cooler cutting action, for the cooler a wheel cuts, the longer it stays sharp. This cooler cutting quality can be measured by the power consumption. Practically speaking, 100 per cent of the power consumed in any grinding operation—that is, 100 per cent of the power transmitted to the wheel—is converted to heat. Therefore, the less power, the cooler the cutting action. In one series of tests comparing a white wheel and one made of 32A, the wheel wear was 20 per cent less for a power input of 350 watts. Conversely, for the same wheel wear, the power consumed with a white wheel was 450 watts, and with a 32A wheel, 310 watts.

In some cases, certain feeds have been increased from 0.0005 inch to 0.002 or 0.003 inch. One tool-room job involved the grinding of air-hardened chromium die steel. The usual practice with a 46 grit, Grade H white wheel was to use

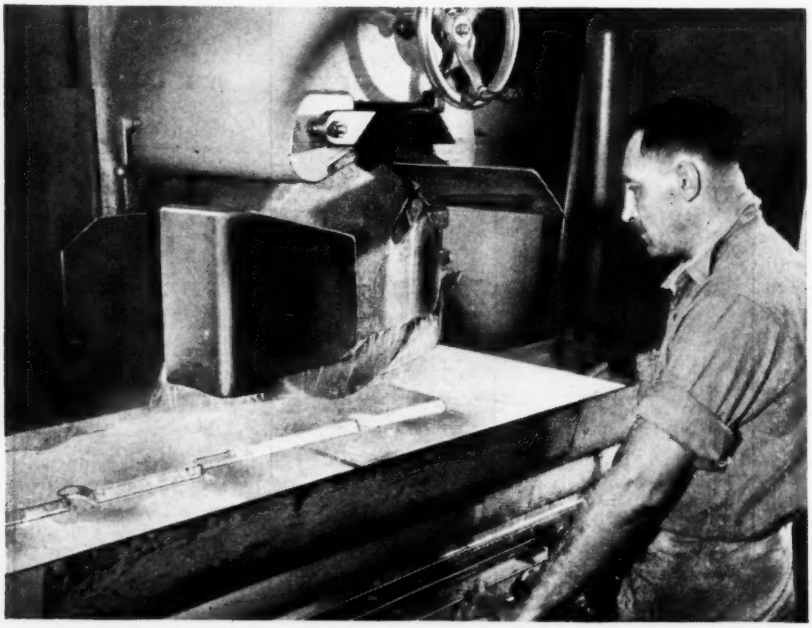


Fig. 3. Many Holes, Grooves, and Slots are Machined in the Cast-iron Core Plate Shown being Surface-ground. Because It Cuts Deeper and Removes More Metal per Pass, a Wheel Made of the New Fused Aluminum Abrasive Does Not Round off the Edges of the Slots. In Addition, It Decreases Machining Time. This Job was Done in About One-half the Time Formerly Required

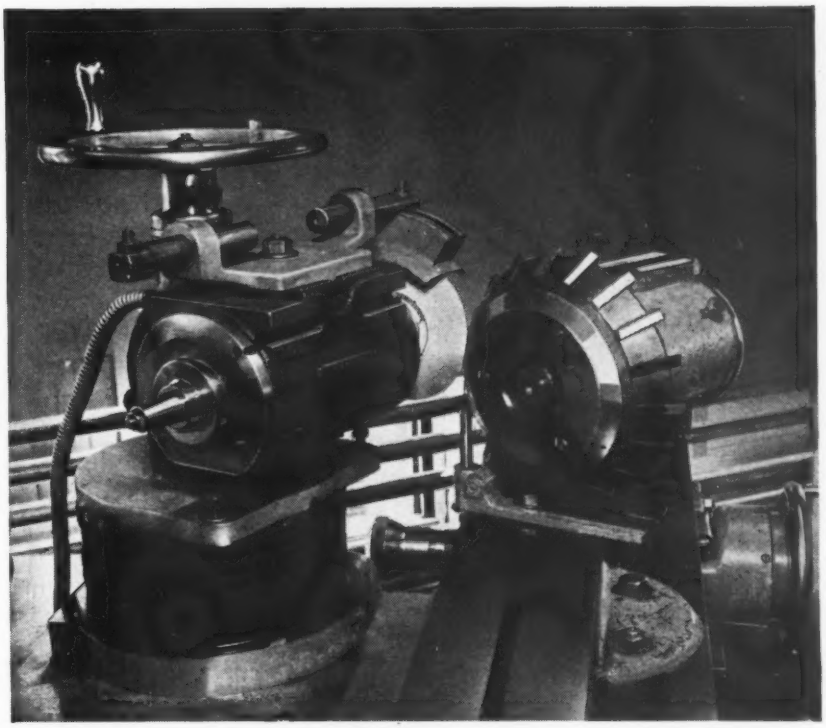


Fig. 4. Grinding a High-speed Steel, Multi-toothed Milling Cutter with a Dish-shaped Wheel. No Coolant was Used during the Operation. The New Abrasive did Not Glaze so Rapidly nor Burn the Teeth so Quickly as a Regular White Wheel. Average Time before Burning was More than Six Passes of the 32 Alundum Wheel, as Compared with Two Passes of the White Wheel

a down feed of 0.001 inch; with a 32A60-H8VBE wheel it was possible to use a down feed of 0.010 inch per pass, and to maintain the same cross-feed without burning the work. However, these values are unusually high, and might not be possible with a larger wheel.

Another typical case involved the grinding of heat-sensitive die steels. The maximum feed with white wheels has been 0.003 inch, and even this occasionally caused burning or heat distortion. Using a 7- by 1/2- by 1 1/4-inch-32A46-H8VBE wheel, the feed was increased to 0.008 inch with minimum heating and a 15 per cent increase in life.

The abrasive works well on other materials besides high tensile-strength steels, and gives promise on tungsten-carbide tools. One test was made with 32A46-H8VBE and 32A46-I8VBE wheels in performing a wet surface grinding operation on the ends of dies. The machine was a Brown & Sharpe surface grinder; the wheel was 7 inches by 1/2 inch by 1 1/4 inches. The die was a wire-drawing die made of high-carbon steel having a hardness of 40 Rockwell C. It was 1 1/4 inches in diameter and 1 3/4 inches high, and had a solid carbide cylindrical insert 11/16 inch outside diameter, 5/64 inch inside diameter, and 15/16 inch long. Because of the design re-

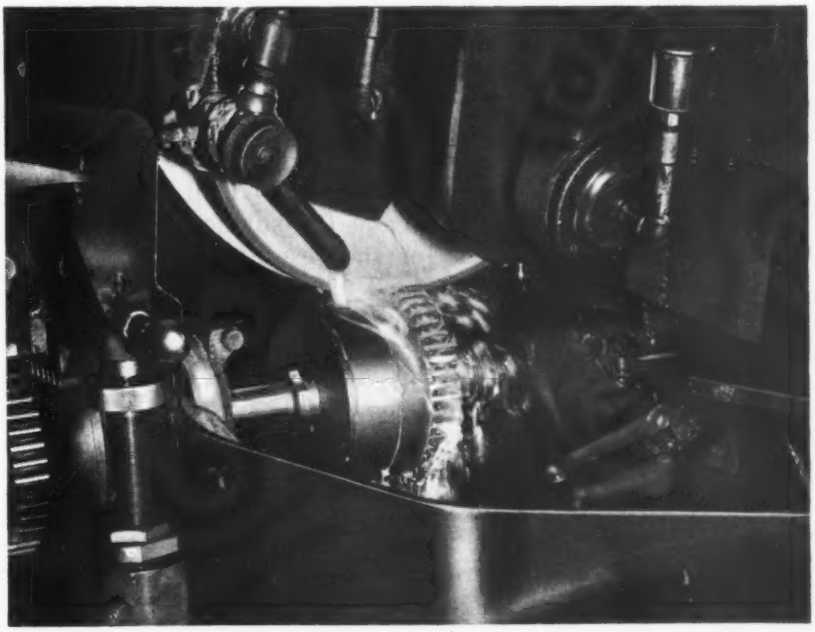


Fig. 5. Using a 32A54-J5VBE Wheel on a Pratt & Whitney Gear Grinder for Grinding a Small Mild-steel Gear. Production and Wheel Life were Increased by 25 Per Cent over Those Obtained with a 38A54-J5VBE White Wheel. Another Advantage is that the Wheel Requires Fewer Dressings per Unit of Material Removed

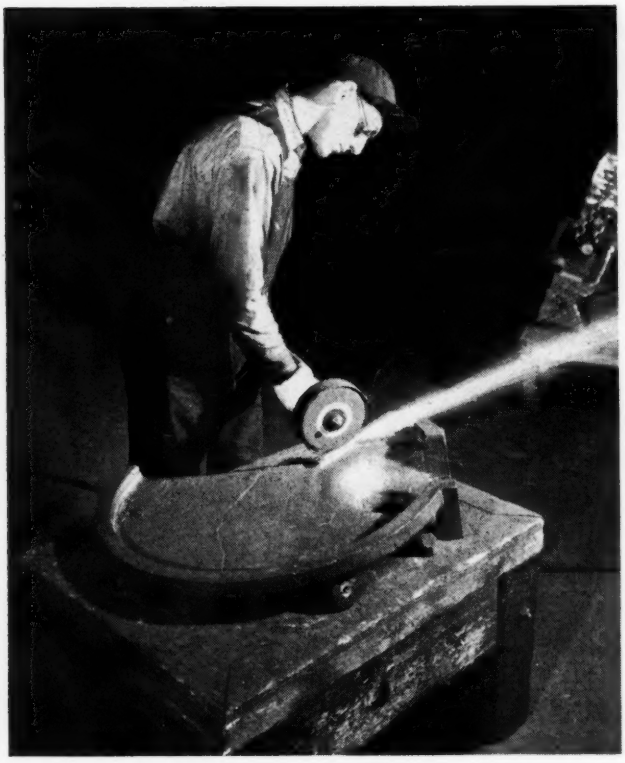


Fig. 6. Off-hand Snagging of Welds, Billets, and Steel Castings is Speeded up with the New Norton Fused Aluminum-oxide Abrasive. A Resinoid Bond is Recommended for Most Work of This Kind

quirements, the piece had to be finished flat; previously, a 100 grit, diamond-resinoid wheel had been used to remove 0.010 inch from the surface.

The 32 Alundum wheel removed material three times faster than competing wheels, but left a slight hump about 0.001 inch high in the center of the insert. The die was subsequently finished with a diamond wheel. A saving in wheel cost and an over-all decrease in production time were the result.

The same wheel was then used to test grind the carbide insert only. Its over-all diameter measured 0.904 inch. After grinding with a total down-feed of 0.010 inch at the rate of 0.001 inch per pass, the piece measured 0.9005 inch. That is, 0.0035 inch was removed from the surface, and wheel wear accounted for the rest of the feed—0.0065 inch. There seemed to be no heat generated in grinding and the insert end was flat. While these results are encouraging, they might not hold true for cylindrical grinding of carbide steel pieces that are springy.

The difference in feed and cut in the preceding test illustrates a common difficulty in grinding flat dies, surfaces having a number of holes, slots, or multi-thickness pieces. Quite often, there is considerable difference between the feed and the amount of metal removed in a grinding operation, because the wheel will not remove stock fast enough, the difference being taken up by compression of the wheel, spring in material, etc. When the wheel comes to a groove, hole, or slot, the compression forces it down into the indent, and in doing so, rounds off the corners. Since cutting action is better with the new abrasive, there is less tendency to grind radii on indentations in the stock.

The new type wheels have been used to surface-grind such parts as the cast-iron core plate shown in Fig. 3. The feed on this job was 0.002 inch, the stock removal between dressings was 0.020 to 0.030 inch (twice as much), and the grinding time was less than formerly required. There was no chatter or heat cracks on the work.

Of course, surface grinding is not the only application for the new abrasive. Other applications include all types of tool-room grinding; form grinding; and several other types listed in Table 1. This table is a compilation of specifications for wheels that have worked well on specific grinding operations. When possible, the type of work, material, wheel specifications, and wheel size have been given. Each of these examples is an interesting application, but space permits only a generalization for the major classifications:

Tool Grinding—The time for some jobs has been cut by 50 per cent. Outstanding advantage is the cooler cutting quality, which permits fast grinding of high-speed steels and other tough alloys.

Internal Grinding—Wearing ability of the new abrasive permits internal grinding with less chance of taper caused by wheel wear.

Cylindrical Grinding — High stock removal with cooler cutting action but a slightly rougher finish, when compared grit for grit with other wheels. Up to the present, most jobs have involved small parts. Shows promise.

Snagging—For floor-stand or portable grinding, 32A wheels have successfully ground steel and alloy castings, forgings, and welds. Resinoid wheels are mostly recommended for this work.

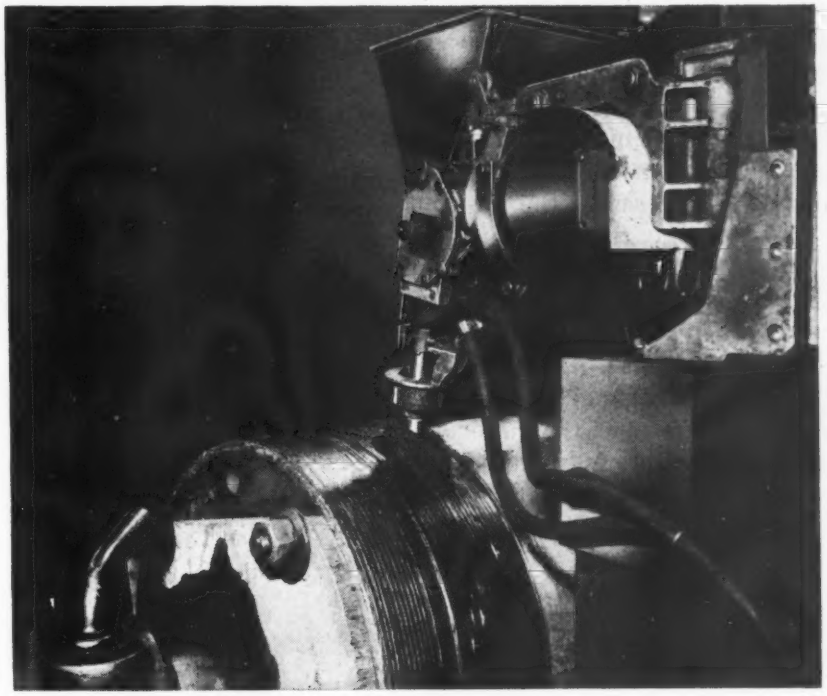
Crankshaft Grinding—In specially bonded A type vitrified wheel, 32A gives promise of excellent results.

* * *

Commercial motor vehicles equipped with lighter, stronger, and more enduring bodies of aluminum, magnesium, and stainless steel were described before the S A E National Transportation and Maintenance meeting in Chicago as early future developments. These light-weight bodies have successfully withstood experimental tests.

Depositing Overlaid Surfaces by the Submerged Melt Welding Process

The Application of Unionmelt Welding in Depositing Stainless Steel and Other Alloys on Dissimilar Metals — Abstract of a Paper Recently Presented before the American Welding Society by L. C. Bradburn, J. M. Keir, and J. E. Taylerson, of The Linde Air Products Co., New York



Rebuilding a Hydraulic Plunger, 24 Inches in Diameter by 9 Feet in Length, by the Use of the Unionmelt Welding Process for the Deposition of Resurfacing Metal

UNIONMELT welding has been used for several years as a means of rebuilding or resurfacing machine parts. Most of this work has involved the replacing of material with weld metal of similar composition to that of the part being rebuilt, or at least of similar wearing qualities. Recently, surfacing with dissimilar materials has been undertaken successfully. Thus far, this process has been restricted to rebuilding work surfaces, but it is possible that it may now be used in manufacturing articles composed of dissimilar materials.

High speeds of rod deposition and high operating factors, as well as minimum rod loss, reduction in subsequent machining, and decreased operator fatigue, make the process particularly advantageous for surfacing operations. Rod has been deposited at rates higher than 40 pounds per hour without stub or spatter loss. One concern has found it economical to rebuild large hydraulic plungers by this process, as shown in the illustration.

The building up of surfaces by any welding method requires the complete fusion of the added metal to the base metal, and the quantity of metal added depends only on the thickness of the deposit. With normal submerged melt welding technique, the quantity of base metal fused is frequently twice as much as the quantity of rod fused. When the purpose is to deposit weld metal—not to fuse base metal—it has been desirable to avoid the usual rod dilution, particularly if dissimilar materials are being joined. Techniques have been developed for achieving this aim.

In resurfacing machine parts, the desired hardnesses range from about 150 to 500 Brinell. The hardness range for various combinations of welding rod and Unionmelt material can be narrowed somewhat by the control of preheating and welding conditions. The control of preheating is particularly important in making high-carbon deposits. An initial preheat of from 300 to 600 degrees F. is frequently required, and the preheat must be controlled to prevent excessive build-up of heat. If the temperature of a weld exceeds 600 degrees F., for example, the fused Unionmelt material will be difficult to remove and soft deposits will be the result.

On many resurfacing jobs, cooling during welding becomes necessary because the heat input of the welding process exceeds the heat that is normally radiated from the weldment. When this heat is not carried away naturally, the tem-

perature build-up caused by the welding process is frequently controlled by air cooling. Water cooling is employed when methods can be devised to keep the unfused Unionmelt material dry. Lower weldment temperatures result in harder deposits, but care must be taken to prevent weld cracking, since the high hard-carbon deposits are relatively brittle.

Deposits having a carbon content as high as 0.60 per cent have been made by using high-carbon low-alloy materials. Thus far it has been impractical to make crack-free deposits containing more than 0.40 per cent carbon with plain carbon rods, even if the rod contains as much as 1 per cent carbon. With medium-carbon and high-carbon low-alloy rods, crack-free deposits can be made which are as hard as or harder than straight high-carbon deposits.

Deposits made with Type 420 stainless steel have shown the greatest hardness with crack freedom of any of the materials tried. This material, however, is relatively expensive, and is used only when one or two layers of deposit are necessary. With the proper control of welding conditions, hardnesses between 400 and 500 Brinell can be obtained in a single pass on medium-carbon steels.

* * *

Don't penalize the good worker by keeping him where he is just because he makes such a satisfactory cog in your machine.—*Management*

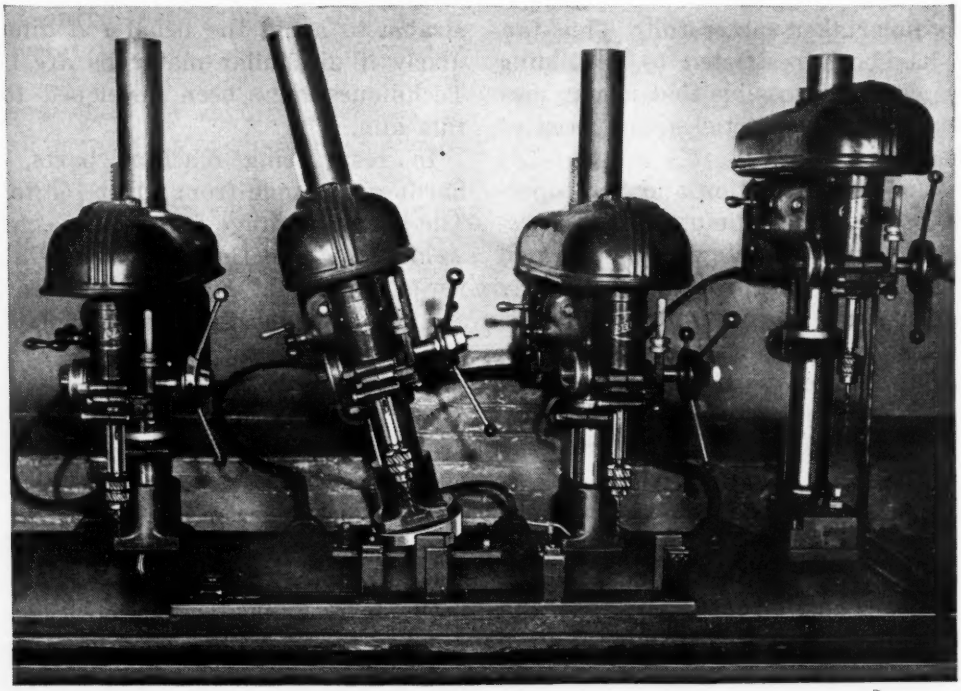
Drill Press Tilted for Angular Drilling

In a series of drilling operations performed on a small part at the Westinghouse East Springfield plant, one hole must be drilled at an angle in relation to three other holes. All of the drilling operations are performed in sequence by the set-up illustrated. The second machine from the left is tilted to the angle to which the inclined hole must be produced.

Tilting this one machine has eliminated the necessity of using a heavy angle-iron or a cradle fixture for the job and reduced work-handling fatigue. At the same time, it has increased production and lowered the cost per piece. The tilted machine is mounted on an inclined base, which consists of nothing more than a piece of heavy steel pipe, cut off at the correct angle and welded to a small steel bedplate, 1/2 inch thick. This bedplate provides added rigidity to the mounting and eliminates excessive vibration.

* * *

Passengers in the high-speed jet-engined airplanes of the near future will travel safely and comfortably, according to Air Commodore Frank Whittle of the Royal Air Force, inventor of the turbo-jet engine, because at the high speeds obtainable by jet-engined planes, bumps do not disturb the airplane as they do at low speeds. One passes through them too quickly.



Battery of Four Small Drilling Machines, One of which is Mounted on an Inclined Base for Drilling at an Angle

Neoprene Applications in Product Design

By S. W. McCUNE, III
E. I. du Pont de Nemours & Co.

Neoprene, since its Introduction About Fifteen Years Ago, has Become an Important Engineering Material. The Diversified Applications Here Described were Selected to Assist the Product Designer in Evaluating the Adaptability of Neoprene to His Designs — This is the First of Two Installments

NEOPRENE, which is formed by the polymerization of the chemical chloroprene, has been applied to numerous products in many industries since its introduction by E. I. du Pont de Nemours & Co., Wilmington, Del., in 1931. Retaining its original properties when subjected to aging, sunlight, ozone, oil, grease, heat, solvents, chemicals, and gases, it has become an important material in the design of modern mechanical products.

Compositions of neoprene are resilient, tough, and durable. They resist permanent distortion and possess superior air-retaining properties and low permeability to gases and fluids. Special compositions are flame retarding, static conducting, and flexible at low temperatures. Neoprene compounds can be molded to complex shapes, which facilitates their application to many designs. The following examples of designs that utilize neoprene are typical, but by no means exhaust the list.

Neoprene Wipers on Machine Tool Ways

Materials commonly used for wipers on the ways of machine tools often pick up and become impregnated with grit, dirt, and abrasive on the wiping surface. Together with the lubricating oil, this forms a lap which wears the ways, or, if the foreign particles are of sufficient size and hardness, may score them. Regular cleaning of the wipers is the only way to minimize this action.

To eliminate this disadvantage, some machine tool builders have adopted neoprene wipers, such as shown mounted on a lathe in Fig. 1. These molded wipers are inserted, under compression, into sheet-metal housings which are fastened to the carriage wings of the machine to insure continued close contact with the ways. The resiliency of the material holds them in this position indefinitely.

Fig. 1. Neoprene Wipers Mounted on a Lathe Insure Adequate Lubrication and will not Pick up Grit and Dirt

Close contact prevents foreign particles from getting between the wipers and the ways, and the neoprene surface will not pick up such particles. Another advantage of this type of wiper is that, with automatic force-feed lubrication, the exposed bedway surface is left dry, thus preventing the sticking or accumulation of chips and dirt. Oil has little effect on the properties of the wiper, and the wipers do not require cleaning.

Use of a Neoprene Diaphragm

An ingenious adaptation of a neoprene diaphragm seal is shown in Fig. 2. In addition to insuring a tight, leak-proof joint, the design permits the rotation of a mechanism within a completely sealed vessel. These joints are used in oil-refining equipment, where the high temperatures, severe pressures, and corrosive conditions

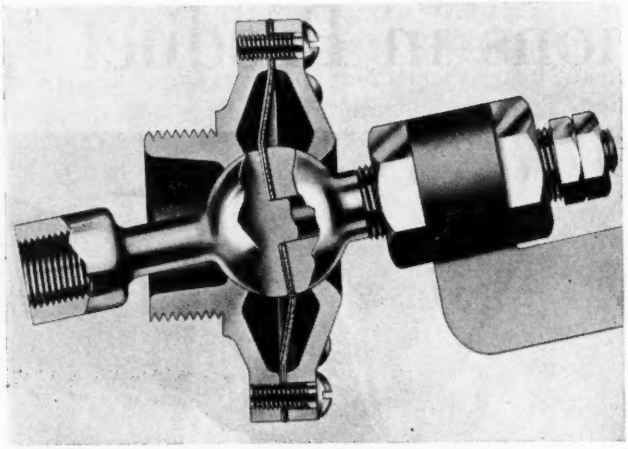


Fig. 2. This Ball Joint, which is Used in a Liquid-level Control Mechanism, Employs a Neoprene Diaphragm Seal

encountered make necessary the use of a material unaffected by exposure to these conditions. The neoprene diaphragm is reinforced by a central layer of strong fabric.

The joint shown was originally used on tanks where the change in liquid level was utilized to operate a mechanical or an electrical device, such as valve, switch, signal, or indicator. For such applications, it was mounted on the side of the tank, with a float attached to the internal threaded shank shown at the left of the joint. Now, however, the joints are mounted on top of the tanks, with a rotating mechanism replacing the float.

Positive sealing is effected by clamping the flexible diaphragm at its outer edge between the flanges of the casing, and at its center between the hemispheres of a separate ball. The hemispheres are aligned and drawn together by a threaded stem on the hemisphere at the left, which extends through the hollow stem of the one at the right. The annular space around the ball is packed with graphite grease for lubrication purposes.

Application to Lubricators

A modern lubricator, as shown in Fig. 3, incorporates neoprene valve trip-rod packing *A*, air-motor piston cups *B*, primer piston-rod packings *C*, and primer-pump piston packings *D*. Hand-gun tube-follower piston cups, coupler nipple seal, gland packings (laminated with duck), air-check valve coupler seal, trigger-valve seal, packings for the nozzle needle, tube gaskets for hand-guns, and meter-cover gaskets for these lubricators are also made of neoprene.

The disadvantages of leather, formerly used for the air-motor piston cups, were that the porous structure of leather, even though treated with a filler, resulted in leakage, and that the filler rendered the leather too stiff to flex properly against the cylinder wall. Neoprene, however, retains the necessary flexibility. Its dense structure insures a positive air seal, and its ability to be molded to special forms permits its application to pistons requiring a seal on both inside and outside diameters.

The reservoir type of pressure lubricator shown in Fig. 4, which is permanently attached to a lubrication passage, delivers a continuous, positive flow of lubricant to the

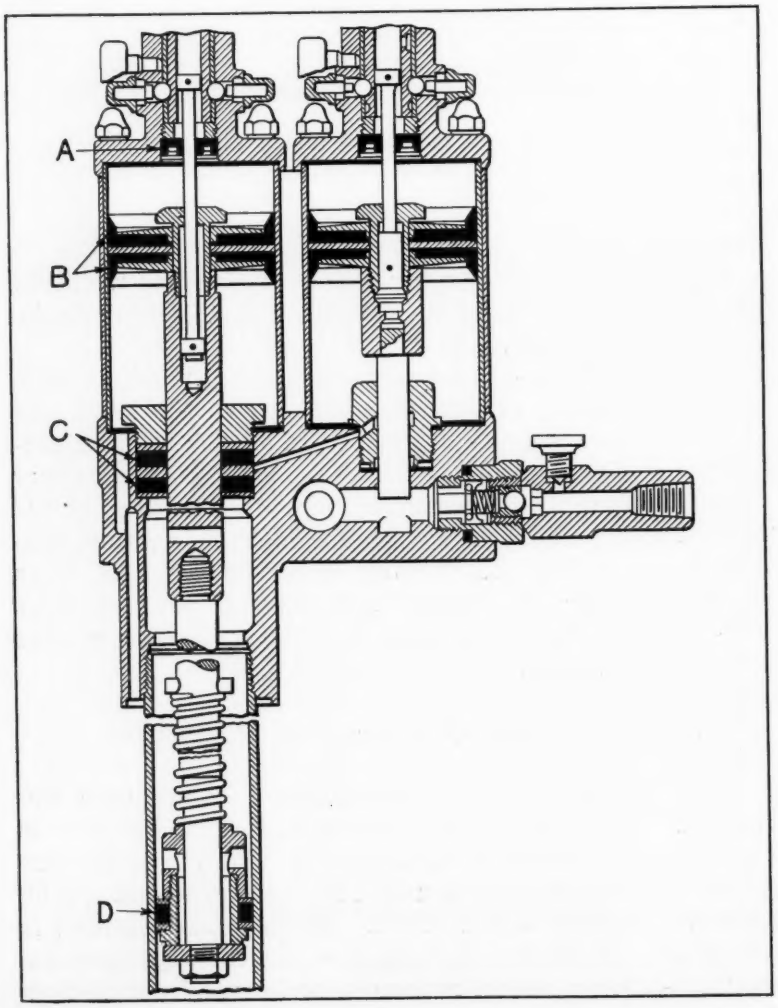
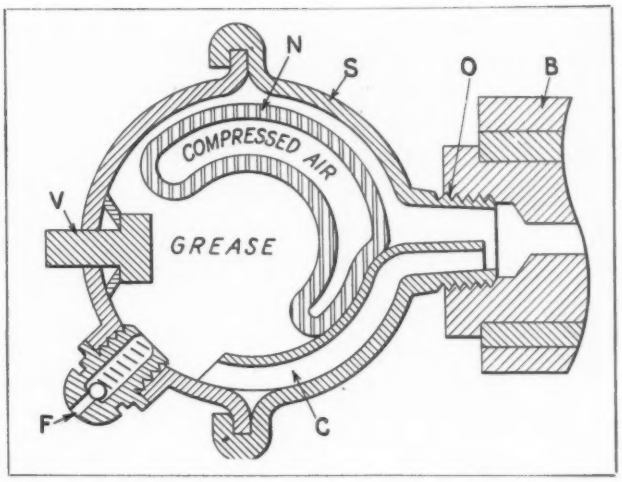


Fig. 3. Neoprene Packing is Used for Many Applications on Lubricators because it Retains its Flexibility and is an Effective Seal against Air Leakage

Fig. 4. A Flexible Neoprene Ball Containing Compressed Air Forces Grease from This Lubricator to Bearings



wearing surfaces of the bearings while they or the shafts are in motion. The lubricator consists of a hollow steel shell *S*, equipped with a standard grease fitting *F*, a pipe thread outlet *O*, and a neoprene relief valve *V*. A flexible, hollow neoprene ball *N* containing compressed air is placed within the shell. When grease is forced into the lubricator, it causes the ball to collapse against the pressure of the air within it, thus compressing the air further and storing energy. As the pressure within the shell decreases, the ball will expand again, increasing the pressure and forcing the grease through channel *C*. When the pressure within the lubricator balances the resistance of bearing *B* to the lubricant, further lubricant is forced to the bearing only when the bearing is in motion. The lubricator, of course, must be refilled periodically.

Neoprene Application to Tank-Car Valves

The presence of scale or other foreign matter between the bronze face and seat of tank-car outlet valves, Fig. 5, is eliminated by sealing the face of the valve while it is open, and by providing a wiping action which cleans scale from the seat every time the valve is closed. This is accomplished by the use of two neoprene parts *A* and *B*, Fig. 6, which are essentially rings surrounding the face of the valve disk when in the open position, although the lower one is webbed across the base of the disk. These neoprene rings may also be seen through the opening toward the bottom of the valve when it is in the open position, Fig. 5. The two rings fit snugly together in their unstressed position, giving the appear-

Fig. 5. Face of Tank-car Outlet Valve is Enveloped by Two Neoprene Rings to Prevent the Entrance of Foreign Matter

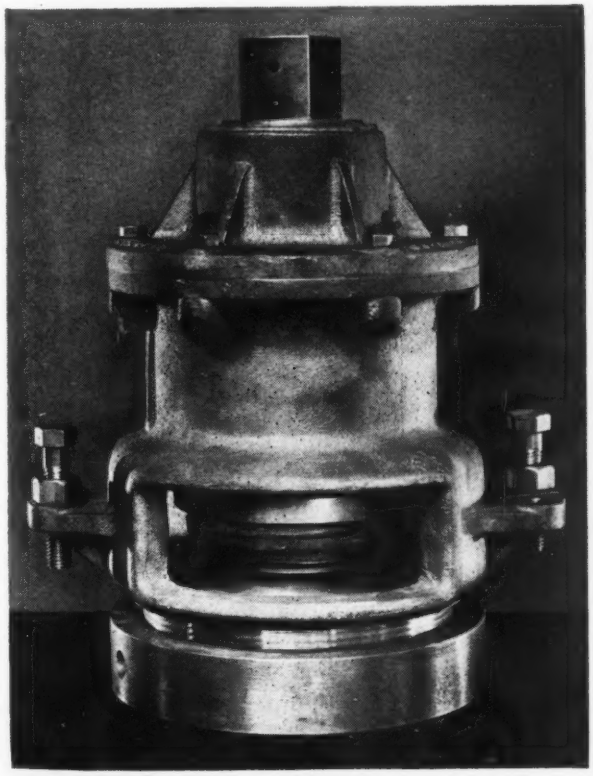
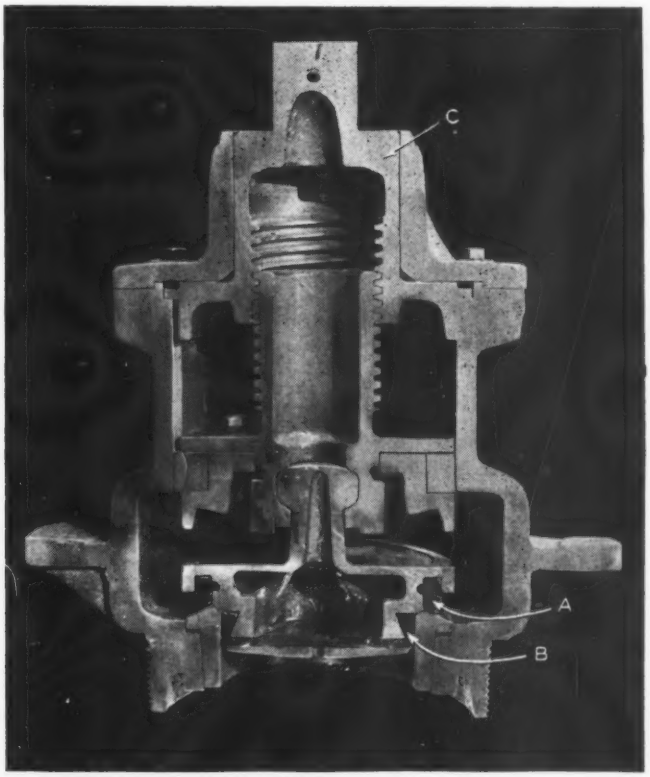


Fig. 6. Sectional View of the Outlet Valve Shown in Fig. 5, Indicating the Relative Positions of the Neoprene Rings A and B



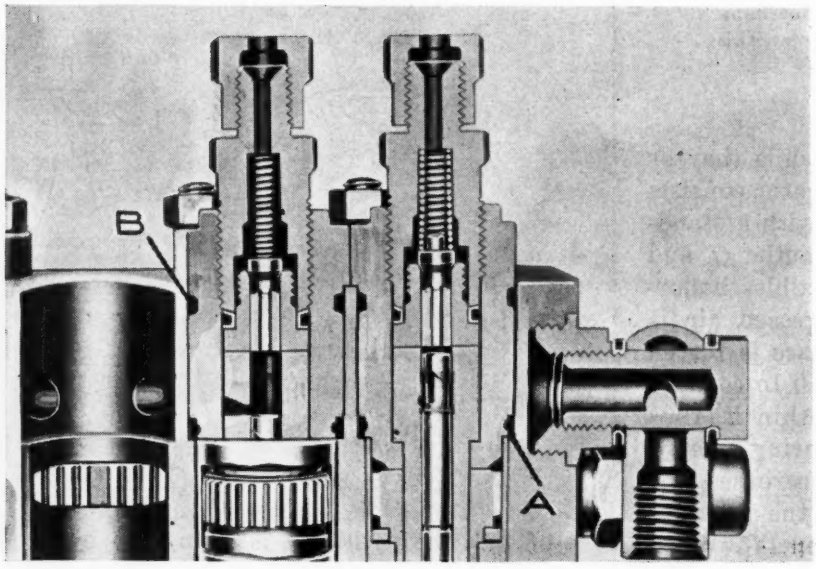


Fig. 7. This Fuel Injection Pump Utilizes Neoprene Gaskets because of Their Resistance to Corrosion by Oil and Their Superior Aging Properties

ance of one ring. When the valve is closed, the rings are separated.

As the valve is moved down by rotating part *C*, Fig. 6, from the top of the tank car, the shoulder of the valve seat comes in contact with the rings at their junction point, thus starting their separation. Further movement of the valve in this direction causes ring *A* to move outward, thus pushing scale from the shoulder and down along the back of the seat, away from the face of the valve. Simultaneously, ring *B* moves across the valve seat, wiping it, and thus presenting a clean surface to the valve face, which has been kept clean by the envelopment of the rings.

When the valve is completely closed, the rings seal off the junction of face and seat to eliminate leakage. Upon reopening of the valve, the resilient neoprene rings return to their former position. Since the seat is always clean, it is not necessary to force the valve in order to close it tightly.

In one design of fuel injection pumps for Diesel engines, neoprene has been used in several parts because of its resistance to deterioration by oils and its superior aging properties. This design is equipped with replaceable pumping units, as shown in Fig. 7, to minimize shutdown time for repairs.

A neoprene gasket *A* is compressed by a central shoulder of the pumping unit, and seals this

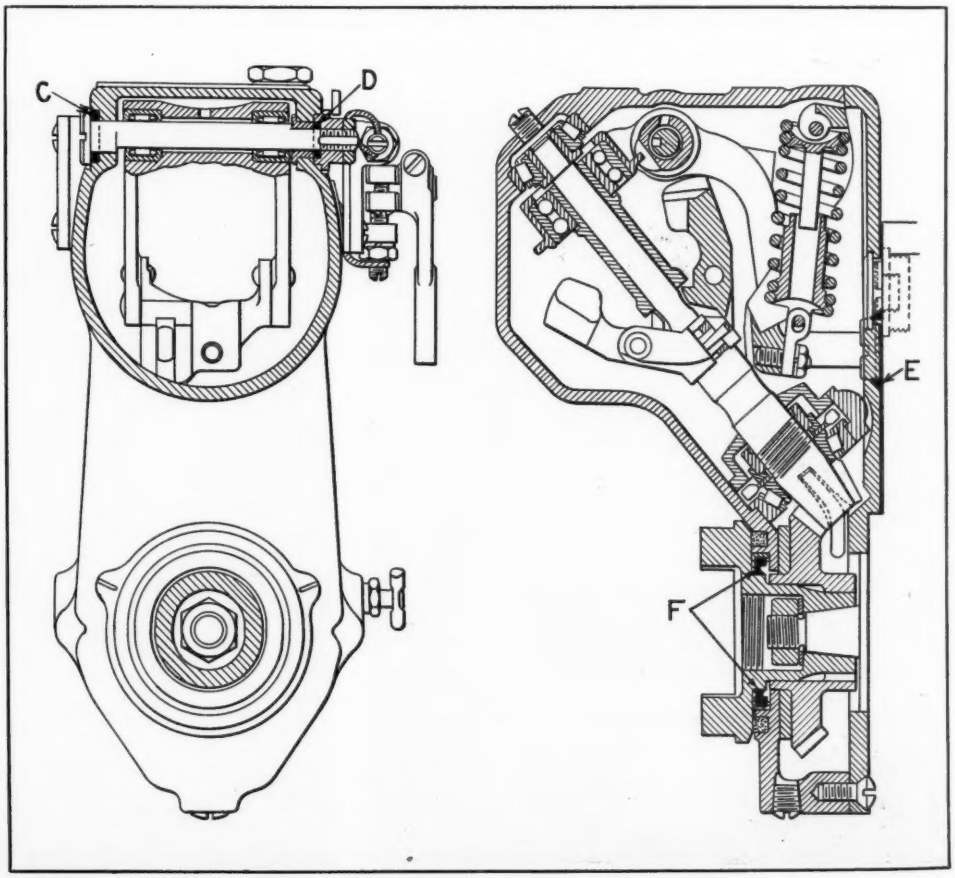


Fig. 8. A Mechanical Governor is Sealed with Neoprene Gaskets to Prevent Leakage of Oil and Entrance of Dust

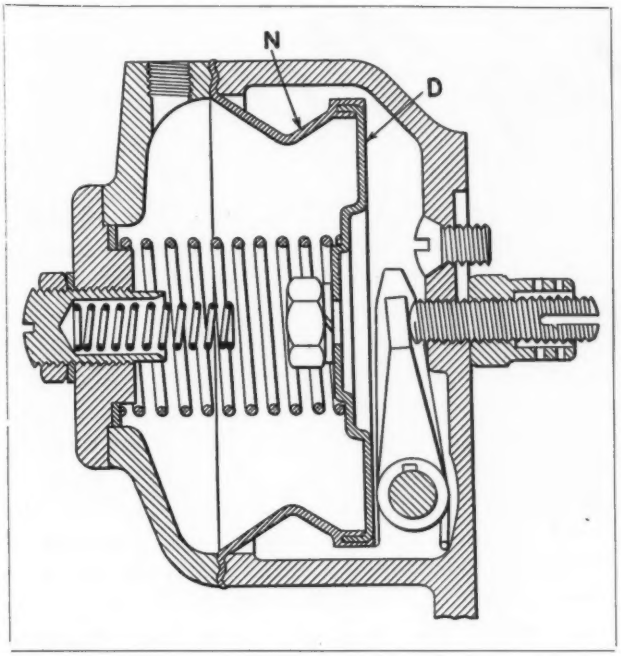


Fig. 9. A Vacuum Governor Employs Neoprene as Part of the Bellows and Diaphragm Assembly because It is Impervious to Oil

unit against loss of oil into the cam-case. Another neoprene gasket *B* fits into an annular groove near the top of the pumping unit body, under the flange. This gasket is compressed against the bore of the pump housing and prevents fuel leakage from the top of the housing.

A cross-sectional view of the mechanical governor used on the same Diesel engine is shown in Fig. 8. Manual control of the governor is accomplished by means of a lever mounted on the outside of the governor housing. The control shaft, shown at the top of the left-hand view, is sealed at both ends by neoprene gaskets *C* and *D* to prevent leakage of oil and entrance of dust. Two other neoprene seals *E* and *F* are shown at the right. The lower gasket *F* seals the driveshaft, while gasket *E* acts as a housing seal.

Neoprene is a part of the bellows and diaphragm assembly of the vacuum type governor shown in Fig. 9, which is used on the same Diesel engines. The disk of this assembly *D* is pressed sheet steel, 0.039 inch thick. It is positioned and the assembly is sealed against leakage by a flexible neoprene diaphragm *N*, 1/16 inch thick. As the vacuum chamber contracts or expands, the diaphragm acts a bellows. Air in this chamber sometimes contains oil, which necessitates the use of a material impervious to it.

A unique rod packing, which is used on a compressor handling a combination of hydrogen and nitrogen gas at 170 pounds pressure, and for other applications where severe service conditions are encountered, is shown in Fig. 10. This packing employs special babbitt metal rings *B*, which are convex on one face and flat on the other, as the seal for the shaft. Neoprene rings *C*, which are concave on both sides to match the metal rings, are inserted between these rings. Beryllium copper springs *A* are embedded in the neoprene rings and seat themselves in recesses provided for them in the metal rings.

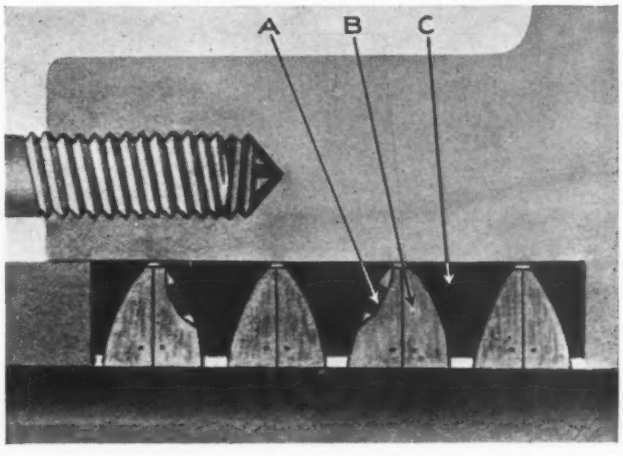
When the packing is used on centrifugal units, the springs prevent the packing from turning with the rod. On reciprocating rods, the springs are so placed that they exert an inward and downward pressure, thus offsetting any irregularity of the rod and compensating for low follower heads and up and down motions or side sway of the rod. A floating seal is thus provided under all conditions. The metal rings seal the rod without touching the stuffing box, and the neoprene rings seal the stuffing box without contacting the rod. As the metal rings are the only ones to touch the rod, a low coefficient of friction is maintained.

Further applications of neoprene in product design will be described in the second, and concluding, installment of this article, which will be published in February MACHINERY.

* * *

The Diamond Tools Committee of the Industrial Diamond Association of America has met with representatives of machinery manufacturers to discuss possibilities for simplifying the use of diamond tools by standardizing the holders. This work is under the cognizance of the Division of Trade Standards, Washington, and it is expected that economy will result to users, both through smaller inventories and saving in time.

Fig. 10. Unique Rod Packing that Uses a Combination of Metal and Neoprene Rings to Provide a Floating Seal



Engineering News

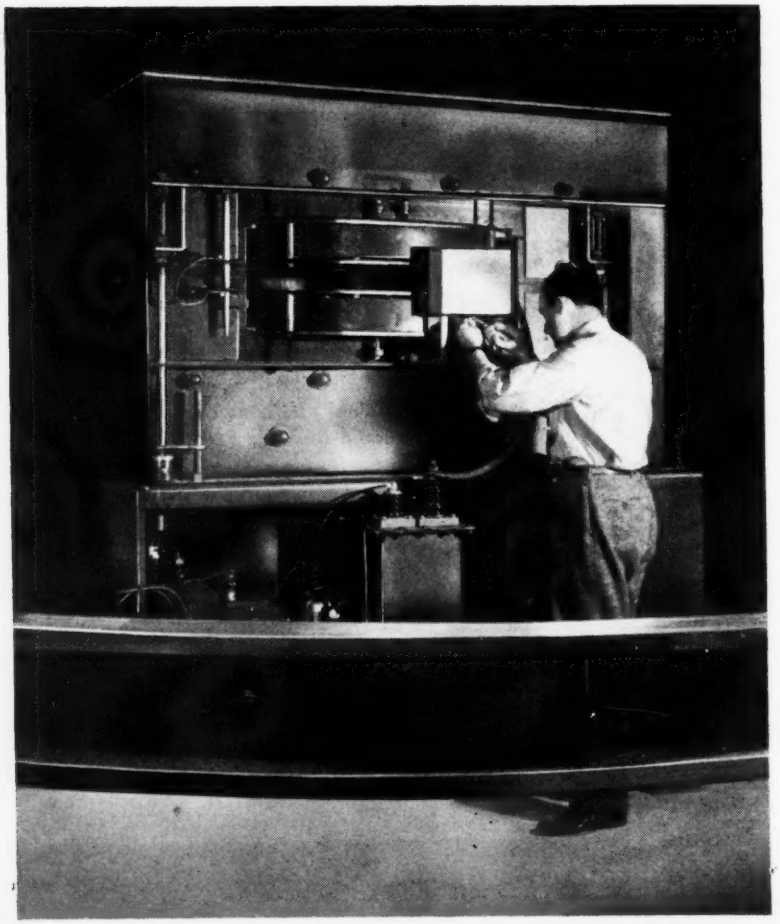
X-Ray Negatives Made through Twenty Inches of Metal

Picatinny Arsenal, the U. S. Army's development center for ammunition, has revealed a device that was used during the war to inspect large munitions. It is the betatron, which was developed by Drs. Kerst, Almy, and Adams of the Physics Department of the University of Illinois, and manufactured by the Allis-Chalmers Mfg. Co.

Unlike other machines, such as cyclotrons or synchrotrons, that accelerate atomic particles to high energy levels, the betatron has practical industrial applications. Its stream of electrons, when deflected to a target, gives up energy that is rich in X-rays, and hence makes possible radiographic studies of steel, brass, bronze, or copper sections as thick as 20 inches in a matter of minutes.

Ordinary X-ray machines operate by building up a high voltage potential between the anode and the target in the X-ray tube, thereby accelerating the electrons. A transformer is used to obtain this high voltage. The betatron substitutes a vacuum tube as the secondary winding of the transformer. Electrons are introduced into the tube, which is shaped like an oval doughnut, by a glowing filament, and are accelerated in 1/720 second by magnetic flux from the primary windings; in that time, they reach a velocity just a fraction of a per cent below the speed of light, and have an energy potential of 20,000,000 electron volts. At the peak of their speed, a pulse of current from an electronic circuit upsets the magnetic field, the electrons spiral off, collide with a small target—about 0.008 by 0.010 inch in size—and create very high frequency X-rays.

The advantages of the machine are these: It can radiograph heavy sections in a few minutes instead of days, as required by ordinary methods; it can detect minute flaws in a specimen regardless of the thickness of the metal; its small focal spot makes possible a sharp and highly defined image; and its energy is concentrated in a small, cone-shaped beam, thus simplifying the protection of personnel.



Making Final Adjustments on the Exposure Control Chamber of the Twenty-million Volt Allis-Chalmers Betatron Installed at Picatinny Arsenal. The Circular Table (Front) is a Conveyor for Large Shells, which can be Inspected as They Pass in Front of the Machine

Welding Equipment Used to Thaw Frozen Water Pipes

Electric welding equipment has been used successfully by a number of plants during past winters to thaw frozen water pipes. The General Electric Co. points out that welding equipment offers advantages over other electrical means because it is self-regulating and can be accurately controlled.

No special equipment is necessary for this application other than pipe clamps that will in-

A Jet-propelled Plane Ready to be Launched by an Electric Catapult that was Developed by Westinghouse for the Navy. Besides its Military Applications, It may be Adapted to Meet the Needs of Commercial Airlines

sure firm electrical connections. Strap type clamps of copper having ample cross-section to carry several hundred amperes are desirable. C-clamps may be used to attach cable terminals directly to the pipe. Zinc oxide, rust, paint, or grease should be removed from the pipe with a file or abrasive cloth to insure good electrical contact. Cable should never be wrapped around the pipe as a connection, since it is practically certain to become loose and may cause sparking.

Electric Launching Device for Heavy Aircraft

An electric launching device is the latest answer to the problem of launching heavy bombers and jet-propelled aircraft from the decks of the Navy's carriers or from small landing fields whose limited runways restrict the movement of large aircraft. It is also being adapted to launch commercial airliners.

Developed by engineers of the Westinghouse Electric Corporation, the electric catapult—"Electropult"—is a huge induction motor, the stator of which has been rolled out flat and the rotor of which has been built into a shuttle car. When current is fed to the coils, the shuttle car speeds down the track and thus launches the aircraft. Running free, the shuttle car can build up to a speed of approximately 220 miles per hour in slightly less than 500 feet; at this speed, it develops 10,000 H.P. Calibration tests indicate that it can launch the largest planes operated by the Navy, with the exception of planes in the Mars class. It has launched a jet-propelled plane at 116 miles an hour in four and one-tenth seconds after a run of only 340 feet.

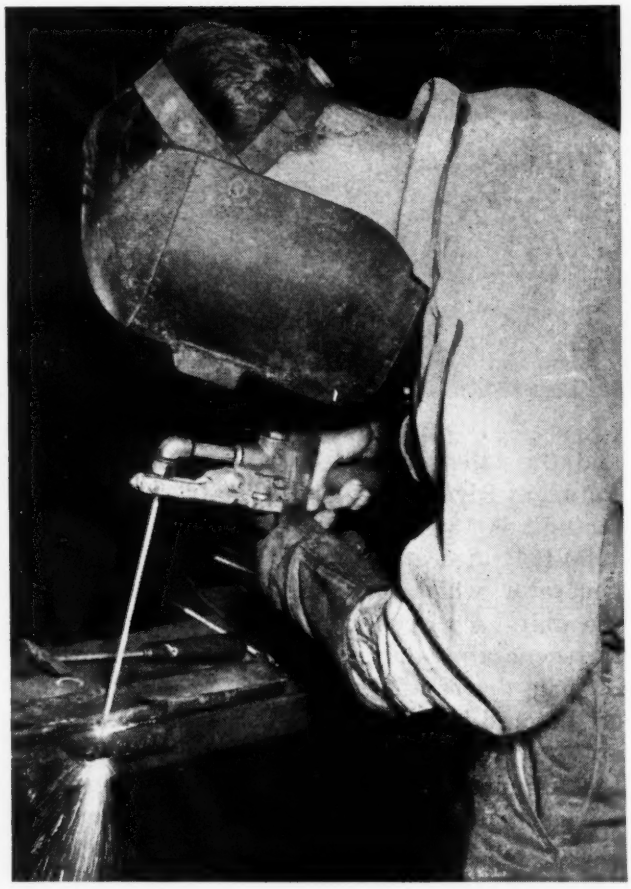
Two Electropults have been built for the Navy, the first installed at Mustin Field, Philadelphia, and the other at the Naval Air Test Center, Patuxent River, Maryland. The track of the latter unit is 1382 feet long. A Pratt & Whitney 1100-H.P. aircraft engine drives a direct-current generator, which furnishes the power to operate the unit. A direct-current motor, connected to this generator, drives a 24-ton flywheel, which, in turn, drives another generator. It is the energy stored in the flywheel that permits the generator to supply 12,000 K.W. of electricity to the Electropult in the first few seconds of operation.

The chief advantage of this electric launching device over the conventional catapult is its gradual acceleration to launching speed. For commercial airliners, maximum acceleration would be about one "G" which means that a passenger would be pressed back in his seat by a force about equal to his own weight.

Large Color Photomicrograph Shown at Metal Congress

A color photomicrograph, 26 inches in diameter, which is believed to be the largest natural color photomicrographic transparency ever produced, was shown at the National Metal Congress in Atlantic City by the Eastman Kodak Co. This photomicrograph is a five-time enlargement of an original color transparency of cast iron, and shows large graphite flakes in a pearlitic structure. The sample, etched in a 4 per cent picric acid solution in alcohol, was photographed by polarized light with a sensitive tint plate at 1800 magnifications. Three color separation negatives were prepared from the original transparency, and positive matrices, enlarged five times, were made from them. These positives were then dyed and bound together in register. The total enlargement was 9000 times.

Electric-Arc-Oxygen Process



ALLOY steels and non-ferrous metals are difficult to flame-cut, the steels because of their great resistance to oxidation, and the non-ferrous materials because of the fast cutting action necessary to prevent conduction of heat away from the working surface. But a new method that utilizes an electric arc and a stream of oxygen to heat and oxidize the metal results in temperatures 3000 degrees F. hotter than those obtained with the oxy-acetylene torch, and permits the cutting of nickel, stainless steel, Monel, cast iron, bronze, copper, brass, and aluminum at speeds comparable to those used in cutting plain carbon steels. This method is a development of the Arcos Corporation, Philadelphia, Pa.

The new method can be used to cut metals to any shape, and in down-hand, vertical, or overhead positions. It will also pierce metal in less time than is required with a high-speed drill, and can pierce or cut stacked materials, even though they are not clamped. Although most industrial applications will be in fabricating and job shops on plate or castings under 3 inches thick, some pieces as thick as 6 inches in cross-section have been cut, and piercing has been done through 12 inches of metal. In cutting these thick sections, however, more than one pass is necessary to burn completely through.

Process Originally Developed for Under-Water Demolition Work

The "Oxyarc" process is a modification of the arc-oxygen under-water cutting method developed during the war by the Navy and several electrode manufacturers, including the Arcos Corporation. The Navy, searching for ways of facilitating under-water demolition, developed a coated mild-steel seamless tube through which was directed a stream of oxygen. This method proved not only fast but efficient, since little operator training was required and the cut could be made by feel, once the arc was established. In addition, there were no adjustments to make; the operator simply regulated the current and pressure at the source, struck the arc, and triggered the oxygen stream.

This equipment was adapted for cutting in air by modifying the rod and holder. The new rod, "Oxycuttend," is somewhat smaller in diameter (about 3/16 inch by 18 inches) and has a different coating. It is consumed during the cutting operation just as an electrode is during a welding operation, but if it is entirely burned away before the cut is completed, a new rod can be inserted and the arc re-established with no effect on the work.

As most welding men would surmise, the function of the coating is to stabilize the arc. Equally important, it insulates the rod from the work, so that it can be dragged over the surface or along a guide or templet without short-circuiting the arc, as shown in the heading illustration and in Fig. 1.

In use, the rod is placed in a special holder, which is about the same size as an electrode-holder and similar in appearance. A toggle-actuated jaw clamps the rod securely and guides it into a rubber washer in the head. Both current and oxygen are fed through the holder, but the only control is a trigger-operated valve for the oxygen supply. No controls for the current are needed, except those at the welding machine. The only other equipment required can be found in any fabricating shop—a cylinder of oxygen with the usual regulating valve and gages, and an arc welder, either of the alternating or direct current type.

Speeds Cutting of Alloy Steels

A Hollow Electric Rod and a Stream of Oxygen are Combined in the "Oxyarc" Cutting Process to Create Temperatures that Cut through Alloy Steels and Non-Ferrous Metals in but a Fraction of the Time Formerly Required. Thin Sheet or Plate up to 3 Inches Thick can be Cut without Distortion or Contamination in One Pass of the Rod

By VALLORY H. LAUGHNER

Before starting a cut, the operator must adjust the current and oxygen pressure to suit the material being fabricated; the voltage is not critical, 24 to 27 volts being satisfactory for all cuts. The rod is available in but one length and one diameter. In welding, there is a critical relationship between the material, the plate thickness, the electrode size, the current, and the voltage, but in cutting, the fundamental objective is to concentrate intense heat on a small area and thus burn out metal. Therefore, the critical relationship is between the current, cross-sectional area of the rod, oxygen pressure and thickness and kind of metal being cut.

It is not usually necessary to adjust the current and pressure in "Oxyarc" cutting for different thicknesses of the same material; except on heavy section, over 2 inches thick, these settings can be maintained at a constant value. This is illustrated by Fig. 2, which shows varying depths of cut being made in chrome-nickel steel with the same setting.

Depending on the material, the pressure may be adjusted from 10 to 125 pounds per square inch, and the current from 130 to 300 amperes. To secure the best results on stainless steels, a relatively high current and low oxygen pressure are used. On the other hand, values of both current and pressure are kept high for clad steels. Table 1 gives some typical values for different kinds and thicknesses of metal.

With current and pressure regulated, the operator strikes the arc and opens the oxygen valve an instant later. No preheat is required. The rod is dragged over the surface of the metal with no attempt to maintain a constant arc length, as in welding.

Performance on Different Metals

The speed with which metal can be cut and pierced by the new process reduces drastically the time required for fabrication. It is an easy matter to clock any particular job and to compute the time saved. Not quite so easily figured, but no less important, is the general speeding up of the flow of work through a shop.

An example of the savings effected with this

Fig. 1. The Coating of the Rod Performs Two Major Functions—it Stabilizes the Arc and Insulates the Rod from the Work, Thus Allowing it to be Dragged across the Work Surface. The Piece Here being Cut is 3/4-inch Thick Nickel

Table 1. Cutting Speeds for Various Metals of Different Thicknesses

Metal	Thickness, Inch	Cutting Speed, Inches per Minute	Current Setting, Amperes	Oxygen Pressure, Lbs. per Sq.In.
Cast Iron	2	2.0	275	40
Bronze	1	3.3	300	25
Monel	1	2.7	250	40
Jessop E-9 Steel	3/4	9.4	200	30
Stainless 20 Per Cent Clad Steel....	5/8	13.5	250	75
Jessop E 200 Steel.....	1/2	9.6	200	15
Nickel	1/2	5.5	250	10
Hastelloy B ..	3/8	9.0	200	25
Aluminum	3/8	15.0	225	30
Copper	1/4	23.0	275	20
Stainless Steel, Type 347.....	1/4	10	275	10

process is the case of a shop that was fabricating tanks made of 1/4- to 7/16-inch 304 stainless steel. An oval manhole, approximately 25 inches along the major axis, had to be cut in one end. This was done by drilling a series of overlapping holes around the circumference and grinding the rough edge after the center was knocked out. The total time for the job was forty-eight man-hours at a cost of approximately $240. When the "Oxyarc" process was employed, the job was finished in forty minutes at a cost of $5.

Removal of rivets and bolts is another job that can be speeded up. Here it is necessary only to cut the head and pierce the shank; the subsequent contraction loosens the rivet and allows it to be knocked out.

Table 1 gives some representative cutting speeds for various metals, with different current and pressure settings, based on actual tests. Note that 1/4-inch copper plate was cut at a speed of nearly 2 feet per minute, while 2-inch cast iron was cut at a rate of 2 inches per minute. As previously indicated, these current and pressure settings can be kept nearly constant for any thickness of material.

To give a more direct comparison of speeds on metal of the same thickness, Table 2 was prepared by interpolation of the data obtained in tests. As in oxy-acetylene cutting, there is a relationship between thickness of metal and speed of cut.

Table 2. Cutting Speeds for Various Metals of the Same Thickness

Metal	Thickness, Inch	Cutting Speed, Inches per Minute
Cast Iron*	1.0	3.75
Bronze	1.0	3.30
Monel	1.0	2.70
Aluminum*	1.0	7.0
Stainless Steel, Type 347*	1.0	2.6
Inconel	1.0	1.67

*Interpolated data based on tests.

In the fabrication of complicated shapes, if holes for flange connections, manholes, or any other shape of connection can be cut in the main vessel after forming, much time, particularly in lay-out, can be saved. Fabricators will find that some of the time-consuming problems that arise in attempting to form pieces with various shaped holes will be eliminated.

Another economy, relatively smaller, is that oxygen is used only when cutting is under way. Oxygen is not used for preheating or for maintaining a flame when not cutting. Both material and time are saved by the fact that cutting can be started and stopped any number of times with the same rod until it is used down to the stub.

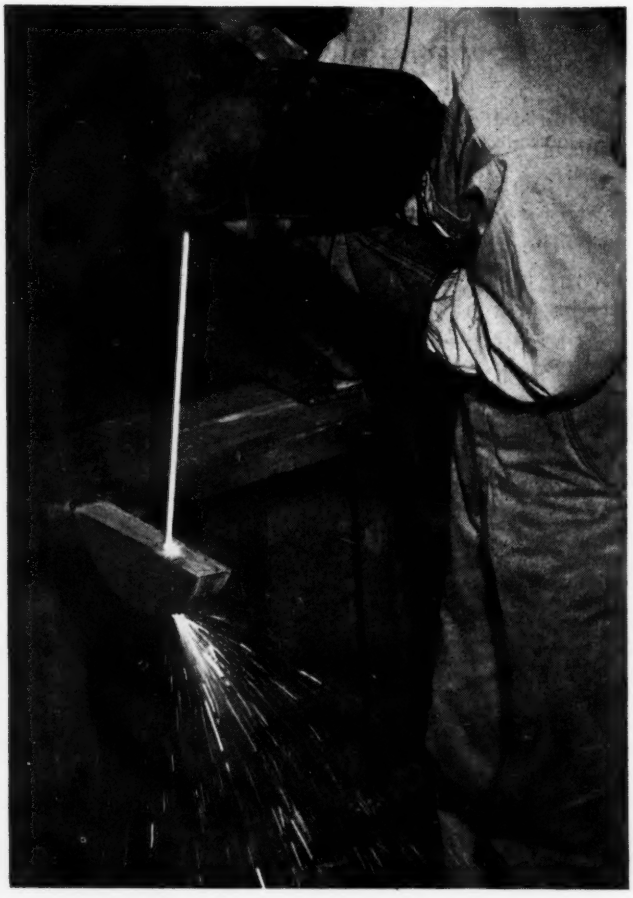


Fig. 2. Current and Pressure are Not Critical when Cutting Different Thicknesses of the Same Material, as in the Case Illustrated. The Piece being Cut is Chrome-nickel Steel. Preliminary Tests Indicated that there is No Contamination of the Base Metal by Oxide Inclusions

Fig. 3. The Surface of a Mild-steel Block after being Cut by the "Oxyarc" Process. Note the Eveness of Cut on This Thick Section

All preliminary tests indicate that the process does not contaminate the base metal, even though a mild-steel rod is used. In cutting austenitic stainless steel, Type 304, a thin surface zone becomes fused. This surface layer—about 0.015 inch deep—contains oxide inclusions, but it is so thin that, even if not removed by grinding, it may be removed by welding, because of weld metal penetration. However, welding on the "as cut" surface is not recommended; the edge should be ground or chipped to remove slag and oxides.

The corrosion resistance of the cut surface is somewhat lower than normal; this is not serious because the metal is removed by a light grinding operation. There is a slight heat effect, but it does not extend more than 1/16 inch beyond the cut. Before cutting, the plate hardness was 75 Rockwell B, and after cutting, average hardness 1/32 inch from surface was 70 Rockwell B.

American Engineers Will Join Permanent World Engineering Conference

Participation of American engineers in a permanent World Engineering Conference, with headquarters in Paris, was disclosed at a business session held during the annual meeting of the American Society of Mechanical Engineers in New York City. The new world technical body will have working contact with the U. N. Educational, Scientific, and Cultural Organization.

The Committee on International Relations of the Engineers Joint Council is the medium for organizing American participation, with headquarters at 29 W. 39th St., New York 18, N. Y. The chairman is Malcolm Pirnie, and the secretary, Stewart E. Reimel. It is planned to set up a national committee with all engineering societies of the United States represented when sanction is received from the Engineers Joint Council.

Fig. 4. Most of the Stainless Steels are Cut or Pierced with Low Oxygen Pressure to Effect the Proper Cutting Action. The Spattering of Oxides Subsides as Soon as the Rod is below the Surface of the Work

Precision Method of Checking

IN a previous article, "Method of Checking Compound Angles," published in December, 1945, MACHINERY, page 182, the writer outlined a method of checking a compound-angle work-piece by means of a toolmaker's knee attached to the face of a sine plate. This is an economical set-up for a one-piece job, but if the length of the work-piece were increased and the size of its component angles decreased, a condition would be approached where this method would fail to meet the requirements of precise measurement. The method to be described meets the needs of precise checking, and at the same time, provides a quick set-up for repetitive inspection.

In the previous method, the work-piece was turned or rotated on the face of the sine plate, and while in this position, the sine plate was elevated to a computed angle which brought the compound-angle plane into a position parallel with the surface plate. Using an angle-block instead of a toolmaker's knee, the same type of compound-angle piece can be positioned by using the following method:

From the point *B*, as shown in Fig. 1, a plane is passed through the block parallel with the end *A'IJK*. This forms the triangular-base prism *B–CAD*, three faces of which, *BAD*, *BAC*, and *CAD* are right-angle triangles. These three triangles are given by construction. It should be noted that, in the fourth face, which is triangle *BCD*, none of the angles is known.

In this particular example, since the value of the angle *ADC* is given as 45 degrees, angle *ACD* is also equal to 45 degrees and sides *AD* and *AC* of triangle *ADC* are equal. Therefore, triangles *ABC* and *ABD* are equal (two sides and included angle of one triangle being equal to two sides and included angle of the other). Hence, angles *CBA* and *DBA* are equal. However, the fact that angle *ADC* equals angle *ACD* makes this a particular case. Other combinations of component angles are not as easily solved.

The following solution may be used as a guide for determining any combination of component angles:

In the right-angle triangles *BAD* and *CAD*, let the common side *AD* be considered equal to unity, or 1; then the value of angle *CBA* is found as follows:

In triangle *BAD*,

$$\text{Cot angle } ABD = \cot 30^\circ = \frac{AB}{AD} = \frac{AB}{1} = AB$$

In triangle *CAD*,

$$\text{Cot angle } ACD = \cot 45^\circ = \frac{AC}{AD} = \frac{AC}{1} = AC$$

In triangle *BAC*,

$$\text{Tan angle } CBA = \frac{CA}{AB} = \frac{\text{cot 45 degrees}}{\text{cot 30 degrees}}$$

$$\text{Tan angle } CBA = \frac{1.0000}{1.7320} = 0.57735$$

Then,

Angle *CBA* = 30 degrees 0 minutes 0 seconds

Therefore,

Angle *BCA* = 60 degrees 0 minutes 0 seconds

With the piece in the position shown by the three-dimensional view in Fig. 1, it is then rotated through an angle of 60 degrees about its edge *A'D*, so that line *CB* will be brought into a horizontal position parallel with the surface plate. The work-piece will then be in position for solving the second unknown angle necessary to position the plane *DBGF* parallel with the surface plate. This second unknown angle is the compound angle of plane *DBGF*, and is formed by the intersections of a vertical plane at right angles to *BC* with this compound-angle plane and with the horizontal plane.

Construct the plane *EAD* in a vertical position (that is, at right angles to *CB* which has been rotated into a horizontal position) and meeting *CB* at *E*. This forms triangular base prism *B–AED*, each face of which is a right-angle triangle. The

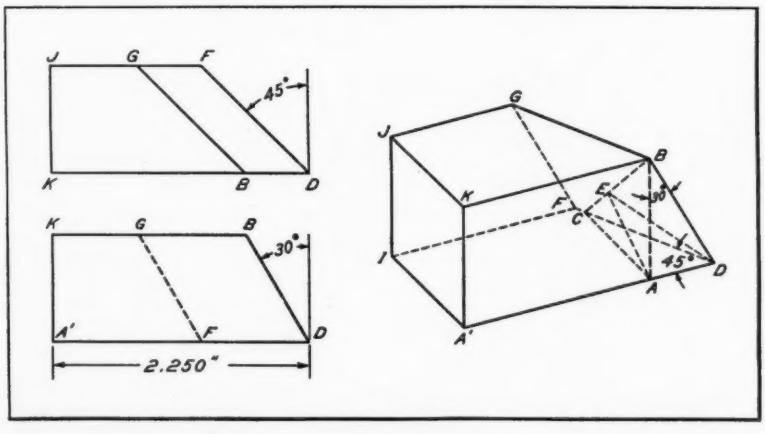


Fig. 1. Top, Side, and Three-dimensional Views of Compound-angle Block, Showing Component Angles, and Plane ABC Parallel with End of Block

Compound Angles

By JAMES AHEARN
Final Tool Inspection Department
Talon, Inc., Meadville, Pa.

angle *ABD* is given, and the value of angle *EBA*, which is the same as the angle *CBA*, is now known. The unknown compound angle is *ADE*.

The adjacent right-angle triangles *BAD* and *AEB*, containing the known angles *ABD* and *EBA*, have the side *AB* in common. Let the length of the side *AB* be considered as unity, or 1; then the unknown compound angle *ADE* is computed as follows:

In triangle *BAD*,

$$\text{Tan } ABD = \text{tan 30 deg.} = \frac{AD}{AB} = \frac{AD}{1} = AD$$

In triangle *AEB*,

$$\text{Sine 30 degrees} = \frac{AE}{AB} = \frac{AE}{1} = AE$$

In triangle *EAD*,

$$\text{Tan } ADE = \frac{AE}{AD} = \frac{\text{sine 30 degrees}}{\text{tan 30 degrees}} = \cos 30°$$

$$\text{Tan } ADE = 0.866025$$

Therefore,

Angle *ADE* = 40 deg. 53 min. 36 sec.

A 90-degree angle-block is used to support the work-piece. As shown in Fig. 2, the position of the 90-degree vee in this block is such that, when the block is resting on its base, in a horizontal position, the work-piece is supported so that face *A'KBD* (Fig. 1) makes an angle equal to *BCA*, or 60 degrees with the vertical, thus placing the imaginary line *BC* in a horizontal position.

The work-piece and supporting angle-block are now placed on a sine plate, and the latter is elevated to an angle of 40 degrees 53 minutes 36 seconds, or the value of compound angle *ADE*, as shown in Fig. 3. This brings the compound-angle face into a horizontal position.

The first step in measuring the work-piece is to place a steel ball in the pocket formed by the faces of the included angle of the angle-block and the supporting end plate, as shown in Fig. 4. The largest size ball that will make proper contact with these faces will give the most accurate measurements.

The vertical distance from the top of the ball to the inner corner formed by the intersection of the vertex of the included angle of the angle-block and the end plate of the supporting block is now computed. This distance is computed in two steps, as shown in Figs. 5 and 6.

Fig. 5 shows a plane passing through the center of the ball and parallel with the end of the block. In this diagram, *FA* is a line drawn from the center of the ball to the vertex of the included angle of the V-block; *FB* is drawn from the center of the ball to its point of tangency with the block, and *EA* and *EF* are, respectively, vertical and horizontal lines forming the right-angle triangle *AEF*.

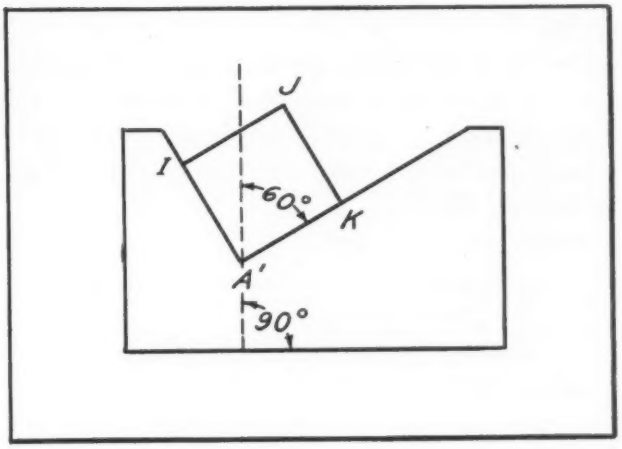


Fig. 2. End View of Compound-angle Block or Work-piece in Supporting V-block

From Fig. 1, the angle *EAB* equals 60 degrees, and angle *CAB*, being the included angle of the V-block, is equal to 90 degrees. *FA* bisects the latter angle; hence, angle *FAB* and *FAC* equal 45 degrees. Assuming that a ball of 1 inch diameter is to be used in this set-up, the computation is as follows:

In triangle *AFB*,

$$AF = FB \times \text{cosec } FAB$$
$$= 0.5 \times \text{cosec 45 degrees}$$
$$= 0.5 \times 1.4142 = 0.7071$$

$$EAF = 60 \text{ degrees} - 45 \text{ degrees} = 15 \text{ degrees}$$

In triangle *AEF*,

$$AE = AF \times \cos EAF$$
$$= 0.7071 \times \cos 15 \text{ degrees}$$
$$= 0.7071 \times 0.96592 = 0.6830$$

Fig. 6 shows a vertical plane passing through the top half of the ball and its center, and a second vertical plane parallel to the first which passes through the lower half of the ball and the vertex line of the angle-block. The latter plane thus contains line *AE* shown in Fig. 5.

The dimension x in Fig. 6 represents the vertical distance from the top of the ball to the corner of the pocket, and is equal to *AI* + *EG* + the radius of the ball. This distance is computed as follows:

In the right-angle triangle *AIO*, the angle *AOI* is equal to the angle of elevation of the sine block, or 40 degrees 53 minutes 36 seconds.

$$AI = AO \times \sin AOI$$

But AO is equal to the radius of the ball, since it is the distance between two parallel lines, one of which passes through the center of the ball and the other of which is tangent to the ball. Hence,

$AI = 0.5 \times \sin 40$ degrees 53 minutes 36 seconds

$$AI = 0.5 \times 0.65465 = 0.32732$$

Angle GEA = angle AOI, since their corresponding sides are perpendicular to each other. In triangle EGA,

$EG = AE \times \cos GEA$

$= 0.6830 \times \cos 40$ degrees 53 minutes 36 seconds

$= 0.6830 \times 0.75593 = 0.51630$

Adding the three elements of x together:

$AI = 0.32732$

$EG = 0.51630$

Radius of ball $= 0.5$

$x = 1.34362$

The ball is then removed and the work-piece is placed in position, as shown in Fig. 3. If, as shown in Fig. 7, a vertical plane is passed through the vertex line of the angle-block and through the work-piece in a similar manner to the second vertical plane mentioned in connection with Fig. 6, and then line DE of Fig. 1 is extended to meet a vertical line from A', the right-angle triangle $DE'A'$ is formed in which the value of the angle $A'DE'$ is known to be the same as that of angle ADE in Fig. 1. Also, from Fig. 1, the length of DA' is known to be 2.25 inches. The vertical distance $A'E'$ from plane $BDFG$ to the corner of the pocket formed by the vee of the angle-block and the supporting end plate is computed as follows:

$A'E' = A'D \times$ sine angle $A'DE'$

$= 2.25 \times$ sine 40 degrees 53 minutes 36 seconds

$$A'E' = 2.25 \times 0.65465 = 1.47296$$

Knowing the vertical distance from the corner of the pocket to the top of the ball and from the corner of the pocket to the plane of the compound-angle face, the distance between the top of the ball and this plane can be readily determined by subtracting the first-mentioned distance from the second, thus:

Distance from corner of pocket to plane of compound-angle face	1.47296
Distance from corner of pocket to top of ball	1.34362
Distance from top of ball to plane	0.12934

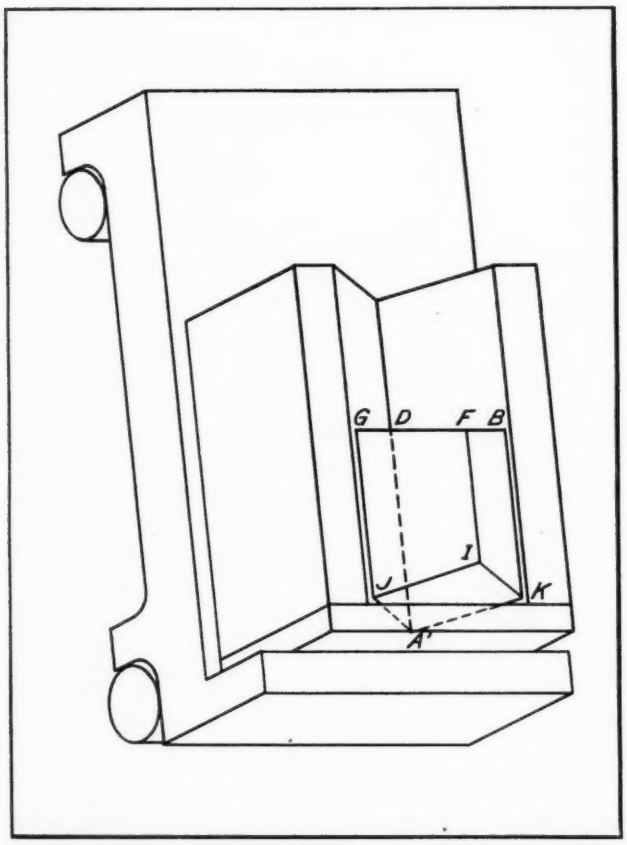


Fig. 3. Compound-angle Work-piece Supported by V-block and End Plate on Sine Plate Elevated to Bring Plane GDFB into Horizontal Position

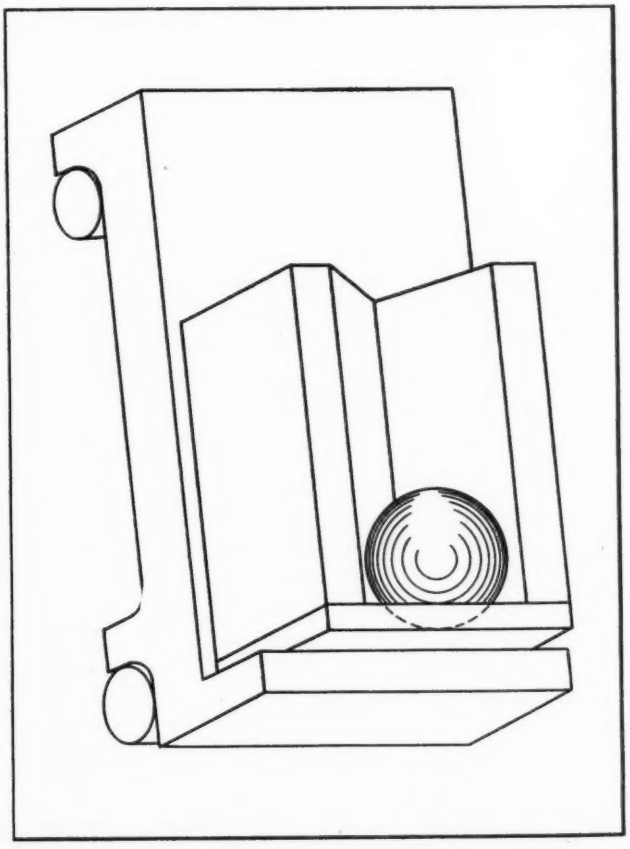


Fig. 4. After Raising the Sine Plate to the Proper Angle, the First Step in Checking is to Replace the Work-piece with a Steel Ball

Having obtained this measurement, the measurement of the work-piece can be checked with the aid of an indicator, planer gage, and precision gage-blocks, as outlined in the previous article.

The advantages of this method are as follows:

(a) The work-piece will always have a full bearing on two positioning faces throughout their length. This is not the case when the knee is used in a set-up in which the component angles of the work-piece are comparatively small.

(b) The base of the indicator will be in approximately the same position for both readings on ball and compound-angle face, and this will avoid inaccuracies introduced by slight errors in sine plate and surface plate.

(c) The angle-block may have all corners relieved by chamfers, and the vertex of the angle-block can be under-cut, so as to eliminate errors caused by small particles of dirt or dust accumulating in the corners.

(d) If repetitive measurements warranted it, the angle-block could be machined so that its base would be at an angle equal to the compound elevation angle with the vertex of the vee, and thus no sine plate would be needed. A compound angle-block of this type would give a rigid support and permit a quick set-up.

The drawing for this work-piece should show an auxiliary three-dimensional view of work-piece and ball, giving the distance from the top of the ball to the compound-angle plane, the angle of rotation, and the angle of elevation to facilitate accurate checking by both toolmaker and inspector.

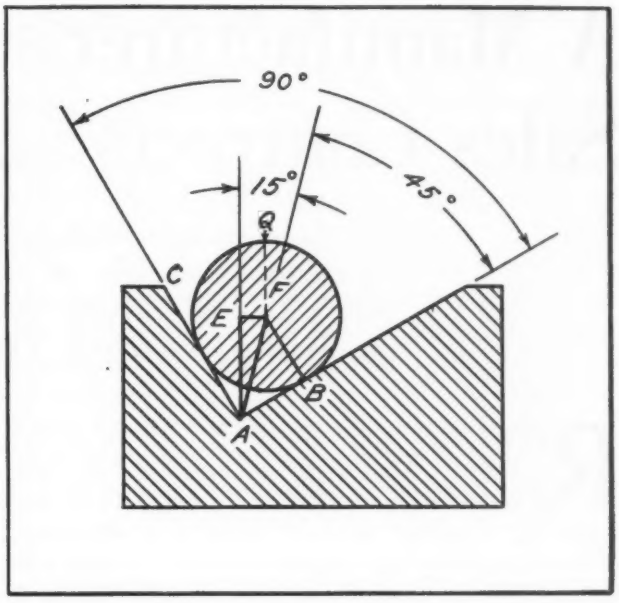


Fig. 5. Cross-sectional View of Ball and V-block in a Horizontal Position, Showing Vertical Distance AE to be Determined

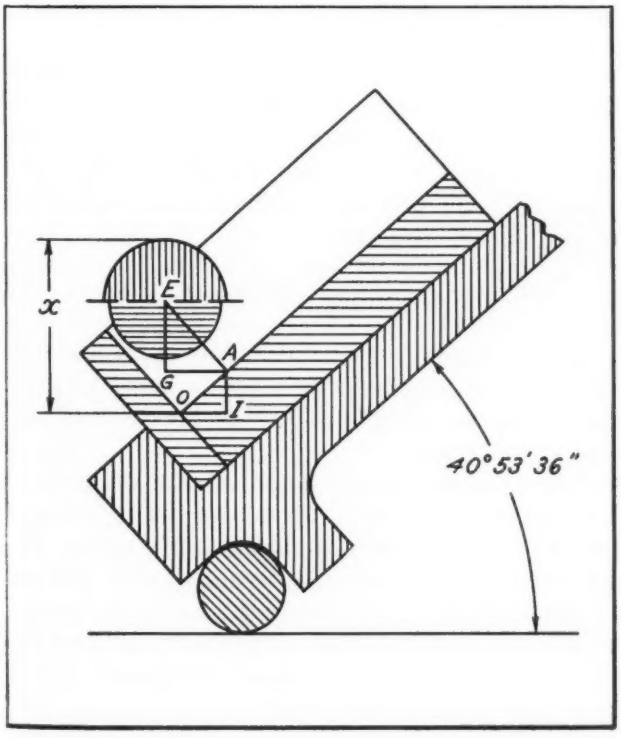


Fig. 6. Sine Plate Elevated to Compound Angle. Distances AI and EG are Computed to Find x. Upper Half of Ball is Shown as Cross-section through Its Center; Lower Half as Cross-section through Vertex Line of Angle-block

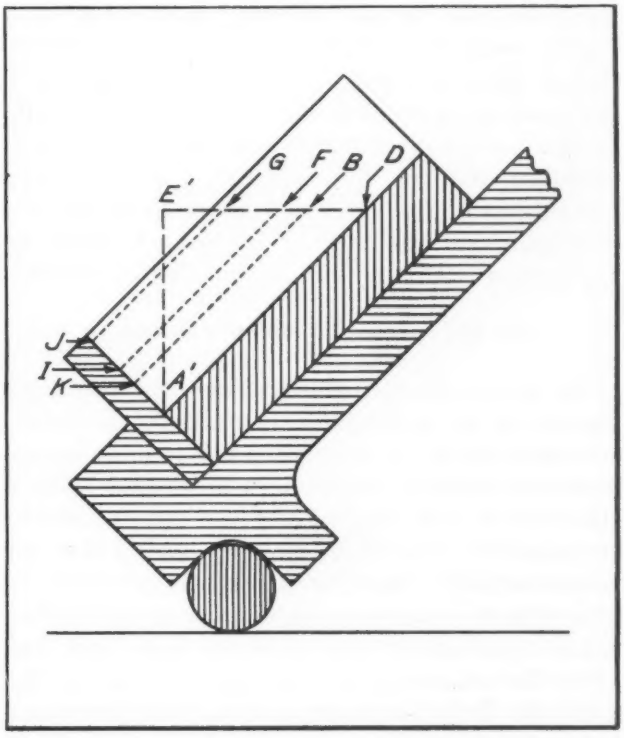


Fig. 7. Phantom View of Work-piece in V-block, Showing Vertical Distance A'E' from the Corner Formed by the Vertex Line of the Angle-block and the End Plate to the Top of the Compound-angle Face

A Manufacturer's Liability on Sales Contracts

By LEO T. PARKER
Attorney at Law, Cincinnati, Ohio

An Examination of Recent Law Suits Involving Contracts for the Sale of Machinery through Distributors Reveals Several Basic Points that May Help the Reader to Avoid Expensive Legal Controversies

RECENTLY a client wrote, in part, as follows: "Yesterday a higher court held our company liable in a $22,500 suit based on a verbal promise made to a purchaser of machinery by our representative. Please give us the law, so that we will know what to do in the future to avoid similar suits."

Either a buyer or seller may recover full and complete damages for the other's breach of any element of a valid contract, but the party who files the suit must prove that the contract is valid and enforceable. Briefly, a contract is valid and enforceable if (1) one party submitted an offer which the other unconditionally accepted; (2) the object and purpose of the contract was lawful; (3) neither party misrepresented facts or exerted undue influence with respect to the other party before the contract was made; (4) both parties were of legal age, of sound mind, and had proper authority to enter into the contract; (5) both parties agreed absolutely to perform definite obligations as to quantity and quality of merchandise, date of shipment, etc.; and (6) the obligations of the agreement were clear and not ambiguous. In addition, if a contract cannot be performed within a year, it must be in writing.

Verbal versus Written Contracts

To avoid expensive litigations, all contracts should be in writing. For example, in International, 53 N. E. 636, reported 1945, a manufacturer became involved in litigation with a distributor who refused to pay for purchased merchandise. The distributor contended that the manufacturer's representative had promised to give him the exclusive agency for the manufacturer's product in Indianapolis, Ind., and that later the manufacturer refused to approve the contract. The distributor testified that the representative verbally promised the exclusive agency and said that later a written contract would be signed by the manufacturer.

The higher court held that a verbal promise to make a written contract is "no contract" and, further, that no agency contract is valid unless its duration is clearly specified. In this case the Court said that without the date of termination in an agency contract the agency would have to be "forever," which is illegal.

Obviously, a manufacturer may cancel an agency contract at any time if the contract fails to specify the duration of the agency. In Phoenix Co. v. Harvard, 45 N. E. (2d) 473, a distributor sued for damages and to prevent a manufacturer from cancelling an alleged agreement whereby the former was appointed an exclusive agent. Since the contract did not specify when the "exclusive" agency would terminate, the higher court refused to hold the manufacturer liable for cancelling the contract, and said: "...The agreement between the parties must be construed as one that was terminable at will by either party upon reasonable notice."

On the other hand, an agency contract is automatically extended for a period of time equal to the term of the original contract, unless the manufacturer notifies the distributor that the same relations will not continue after expiration of the agency contract.

Authority of Agents

Another important point of law is that all distributors dealing with a manufacturer's agent are bound to ascertain the legal extent of the agent's authority.

For example, in the leading case of Anh v. Grevier, 128 F. (2d) 146, a distributor entered into a contract with a manufacturer's agent. The distributor expended considerable money relying on the validity of the contract. Later the manufacturer refused to approve the contract and the distributor filed suit to compel fulfillment of this contract made by the agent.

The Court held that if an agent for a manufacturer has no actual or real authority to make a valid contract for the manufacturer, the latter is not liable under such contract unless the distributor proves that by past conduct of the man-

ufacturer it may be decided that the agent had implied authority to make valid agency contracts. This rule of law means that in order to win a litigation of this kind the distributor must prove that in the past the manufacturer either notified him that the agent had authority to make valid contracts, or that the manufacturer was accustomed to approve all contracts made by this particular agent.

Legal Meaning of Term "Agent"

A great majority of contracts for the sale of machinery are made through agents or salesmen. It is important, therefore, to know that the courts recognize only two kinds of agents, namely, "general" and "special."

A manager, for example, is a "general" agent, because he is employed to perform all acts necessary to the successful conduct of the business. On the other hand, salaried salesmen and agents on commission are "special" agents, whose authority is limited to the performance of a single act—the special and exclusive duty of soliciting orders. Under ordinary circumstances a salesman cannot make a valid contract or guarantee without his employer's approval.

Responsibility of Seller for Contracts Made by Agents

A seller is bound by a guarantee or contract made by an agent or salesman if (1) the employer has notified the purchaser that he will be bound by contracts, statements, and guarantees made by the representative; or (2) in the past the employer has ordinarily accepted contracts made by the representative, under which circumstances a court may imply that he was authorized to make the contract in litigation; or (3) the representative practiced fraud to induce the purchaser to make the contract. If an agent practices fraud the employer is responsible for all acts and contracts of his agent, although the employer did not authorize the agent to make the fraudulent guarantee or contract. If the agent is a partner of the partnership for which the contract is made, the partnership is liable for all contracts made by the partner. Consequently, other partners need not give any partner authority to make valid contracts relating to the regular business of the partnership.

Numerous courts have held that a partnership may comprise one financially responsible partner and other partners without any investment except their personal services. The financially responsible partner always is obligated to fulfill all partnership contracts.

Contracting Parties Must Be Known

Considerable discussion has arisen from time to time over the legal question: Can a purchaser cancel a contract he believed was made with a manufacturer, when actually the contract was made with the manufacturer's distributor?

In Jorgensen Co. v. First National Bank, 14 N. W. (2d) 618, reported 1946, it was shown that two salesmen who represented a corporation known as R. E. S. Inc., approached a purchasing agent to sell him certain equipment. The salesmen gave the agent a circular bearing the name "Westinghouse" prominently displayed and showing a picture of the equipment. The circular also contained a photostat of what was called the "Westinghouse Commercial Warranty" executed by the Westinghouse Electric & Mfg. Co., the manufacturers of the equipment. Assuming that the salesmen represented the Westinghouse Electric & Mfg. Co., the agent agreed to buy the equipment.

In the upper left-hand corner of the order or contract appeared "R. E. S. Inc." Across the top in large type was printed: "Westinghouse Products Department." The agent did not notice the "R.E.S. Inc." printed in the upper left-hand corner. When making a check in payment of the equipment, he inquired of the salesmen the full name of the company and they told him "R. E. S. Westinghouse." R. E. S. Inc. deposited and obtained payment on the check. Some time afterward the agent discovered that R. E. S. Inc. had no connection with Westinghouse except as a sales agency of its products and that his check had been endorsed and cashed by R. E. S. Inc. He then sued R. E. S. Inc. to recover the amount of the check and also cancel the written contract of sale.

In the ensuing litigation the higher court decided that title to the delivered equipment did not pass to the agent, and said: "Of course, only the payee named in a check is entitled to receive payment. R. E. S. Inc. is not the payee named. There being no corporation or firm having the name "R. E. S. Westinghouse," the payee named is non-existent.... Consequently, the endorsement of the check by R. E. S. Inc. transferred no title, and the plaintiff is entitled to recover."

This higher court also held that he could, without liability, cancel the contract, saying: "It makes no difference in such a case that the person with whom the buyer is misled to contract is able to and offers to deliver the identical goods contracted for. A buyer has the right to choose not only the goods he purchases, but the seller of the goods also."

See also Winchester v. Howard, 97 Mass. 303.

In this case the Court held that a purchaser of machinery may revoke a contract of sale immediately upon his discovery that the machinery belonged to a seller with whom he did not choose to deal.

Now, let us assume that the purchaser knows that he is dealing with a distributor, and not the manufacturer of the machinery, but that the distributor breached the contract of sale. What exact legal rights has the purchaser?

A review of late and leading higher court decisions discloses that where there is a breach of contract or warranty by either a distributor or manufacturer, the buyer may (a) accept or keep the machinery and plead the breach to reduce the contract price; or (b) accept or keep the machinery and file a suit against the seller for damages for the breach of warranty; or (c) refuse to accept the machinery if the legal title has not passed, and maintain a suit against the seller for damages for the breach of warranty; or (d) rescind the sale contract entirely and refuse to receive the machinery; or (e) if the machinery has already been received, return it, or offer to return it, and sue for the price or any part thereof which has been paid. However, the purchaser must prove that he was damaged by the seller's breach, or he cannot recover damages sustained.

For example, in Seal v. Fitch, 183 S. W. (2d) 533, reported 1945, the testimony showed that a manufacturer contracted to sell certain equipment for $6000, to be paid in monthly installments. The seller refused to make delivery of the equipment, and the purchaser sued to recover possession of the equipment plus $10,000 damages. During the trial no testimony was given by the purchaser which proved that he was damaged by reason of the seller's breach. Therefore, the higher court refused to hold the seller liable for actual damages.

Exemption Clause in Contracts

All courts hold that no contract is valid which contains a clause intended to relieve a seller from liability for his own negligence. Outside of this simple restriction, contracting parties are at liberty even to unreasonably obligate themselves.

In Monarch Co. v. Meyer Co., 130 F. (2d) 583, it was shown that a seller of machinery guaranteed to replace defective parts, but the contract also contained a clause which clearly exempted the seller from liability for any and all delays—damage or consequential damage arising from shipment, erection, or operation of the machinery. In subsequent litigation the higher court held that when the purchaser signed his contract he assumed obligation to accept and pay for the machinery, irrespective of the fact that he was dissatisfied.

Also see Welkner v. Di Carle, 27 A. (2d) 351, where a contract provided that the machinery had been "completely reconditioned and service was guaranteed one year free." After the purchaser had the machinery for several weeks he discovered that it was defective and needed repairs. In fact, it was so unsatisfactory that he finally put it in storage and bought a new one. The Court held that the purchaser was obligated to pay the full purchase price for the machinery, but that he could deduct from the contract price the total expenses incurred in repairing the machine to make it comply with the guarantee.

Also, according to a recent higher court, a purchaser who acknowledges to the seller that he is "satisfied" with the machinery forfeits his legal right to later sue and recover from the seller, even though the equipment be defective.

Buyer Cannot Accumulate Damages

No higher court will allow a buyer to recover from a seller damages accumulated by acts of the purchaser not authorized by the seller.

In Fiedler, 63 N. E. (2d) 310, a purchaser of machinery discovered within a few days after accepting delivery that it would not perform according to the guarantee given by the seller. However, the buyer continued to use the machinery without affording the seller ample opportunity to comply with the guarantee. Later the buyer sued the seller to recover all damages he sustained resulting from breach of the seller's guarantee.

The higher court refused to allow the purchaser damages, saying "The evidence is that after appellee (purchaser) knew that the machine would not work satisfactorily he nevertheless proceeded to use it. . . ." So, it is quite apparent that no purchaser may recover damages he sustained as a direct result of his own conduct, notwithstanding the fact that a seller breached a valid guarantee.

* * *

Success in the field of mass production depends upon ever lower costs. Lower costs make possible greater quantity production and greater quantity production makes possible lower prices. No manufacturer in a mass production industry is interested in any program involving higher prices for fewer products. Nothing gives the mass production manufacturer greater dissatisfaction than rising costs and rising prices.—*Henry Ford II*

Inspecting and Measuring Jet-Propulsion Blades

THE production of blades and buckets having accurate profiles has been a problem of major importance in the development of jet propulsion. One of the greatest difficulties encountered has been the lack of an accurate and rapid method of inspecting and measuring the formed surfaces or profiles of the blades, which somewhat resemble the curved surfaces of a spoon. With this comparison in mind, it would seem impossible that a standard comparator, such as is employed for the inspection of precision screw-thread profiles, could be equipped to provide an accurate and rapid method of inspecting jet-propulsion and turbine blades. Nevertheless, this has been accomplished by the "Pant-O-Jector" method of gaging, developed by the Engineers Specialties Division, Universal Engraving & Color Plate Co., Inc., Buffalo, N. Y., which employs equipment or attachments such as are applied to the standard comparator shown in Fig. 1.

Profiles of thin sections cut from a blade could, of course, be projected on the comparator screen, in the conventional manner, at a suitable magnification for comparison with a master profile outline. Such a method, however, aside from being too lengthy, is not applicable to the inspection of blades intended for actual assembly in the product.

The "Pant-O-Jector" equipment, which has satisfactorily solved the problem of accurate inspection of jet-propulsion blade profiles, combines the operating principles of a pantograph and an optical projector. The blade to be inspected, as shown at *W*, Fig. 2, is gripped by its root in the work-holding fixture, which can be adjusted to hold the blade surface to be checked in the required position.

The roller *D*, also shown in the diagram at the upper left-hand corner of Fig. 4, is then traversed over the upper surface of the blade *W*. This traversing motion transmits a vertical movement to the slide *F* and a horizontal movement to slide *G*. The combined movements cause one of the holes or "eyes" *E*, mounted on the vertical slide *F*, to follow a path that is an exact duplicate of that followed by roller *D*. Thus, as *D* moves over the surface to be inspected, a light beam projected through one of the "eyes" *E* forms a ball or disk of light *E* on the screen, as indicated in Fig. 3.

This projected disk-shaped spot of light follows a path which accurately duplicates that of roller *D*, but at a greatly enlarged scale. The accuracy of the blade profile is determined by the closeness with which the periphery of the light spot *E* follows the master profile lines of the chart gage on the screen. Two profile lines, spaced to represent the allowable tolerance, can

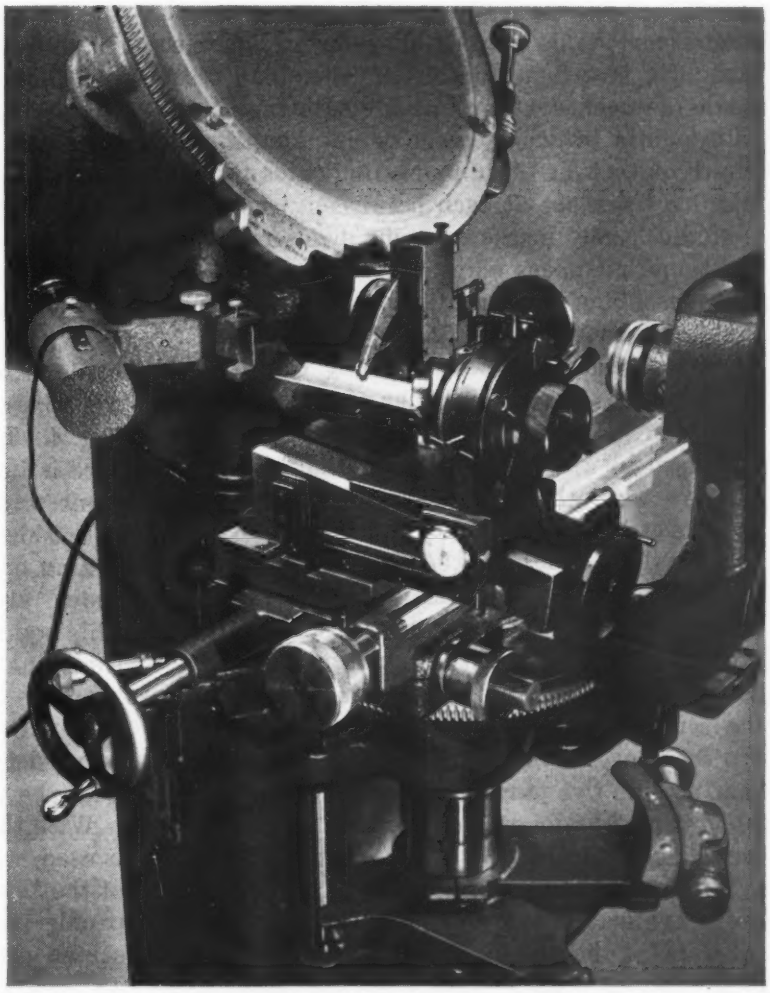


Fig. 1. Optical Comparator Equipped with "Pant-O-Jector" for Inspecting Profiles of Jet-propulsion Blades

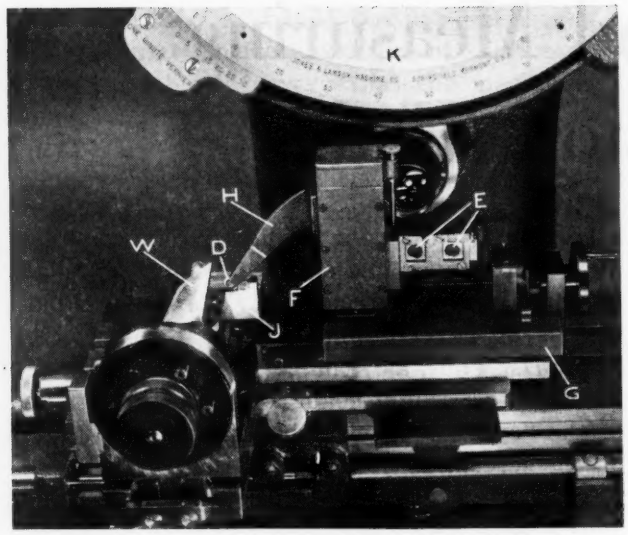


Fig. 2. Front View of "Pant-O-Jector," with Roll D of Traverse Arm H Set on Block J to Align Image of "Eye" E with Master Lines of Chart Gage on Screen K

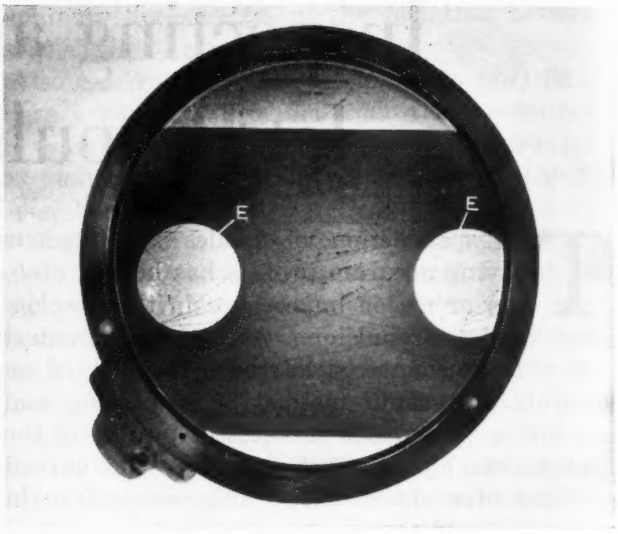


Fig. 3. Images of Twin "Eyes" E Projected on the Screen, with Second "Eye" Picking up the Profile Line as the Image of the First "Eye" Passes off the Screen

be provided on the screen to permit rapid inspection of the blades, if desired. The chart gage *K* on the screen shown in Fig. 2 has master contour or profile gaging lines for various sections of a jet-propulsion blade. The small cross-marks on each contour line indicate the coordinate points which determine its shape. The length of each of these marks indicates the permissible tolerance at each point.

Modifications in the equipment described and additional members may be needed to meet certain measuring or inspection requirements. The equipment shown in Fig. 2, for example, has two "eyes" *E*, whereas that shown by the diagram in the upper right-hand corner of Fig. 4 has only one "eye." If the length of the blade profile traversed by the roll *D* is such that the profile path traced on the screen does not extend beyond the screen, only one "eye" is required.

Since the chordal lengths of the average blades inspected with the equipment shown in Figs. 1 and 2 are from 1 to 2 1/2 inches, the profiles projected on the screen to a magnified scale of 10 to 1 would be from 10 to 25 inches long. As the screen is only 14 inches in diameter, any projected profile that is longer than 14 inches is split up into two parts by employing two "eyes," which are usually spaced exactly 1 inch from center to center.

With this arrangement, the first "eye" traces the magnified profile of the blade followed by roller *D* for the first half of its traversing movement. As the path traced by the first "eye" passes beyond the screen, it is continued by the second "eye," which appears on the opposite side of the screen. Thus, one pass of the roller *D* over the blade results in tracing the profile on the screen to a magnification of 10 to 1, with the magnified profile split up into two lines, the beginning of the second line being simply a continuation of the one traced by the first "eye."

The projected path traced on the screen can be broken up into three or even more lines by employing the necessary number of "eyes" where a greater magnification is required or a wider blade is to be inspected.

The blade-profile tracing equipment shown in Fig. 1 is designed to inspect only one side of the blade at one setting of the work, as indicated in the diagram in the upper left-hand corner of Fig. 4. For inspecting the opposite side, the fixture is indexed 180 degrees. A tracer arrangement with two contact rollers, which permits both sides of a blade to be checked without indexing or changing the position of the blade, is shown at the lower left-hand corner of Fig. 4. This equipment does not check both sides at one time, but checks the upper side when downward pressure is applied to keep the upper roll in contact with the blade, and the lower side when upward pressure keeps the lower roll in contact with the under side of the blade.

With this arrangement, a double "eye" bracket is used, with the center-to-center vertical spacing of the "eyes" the same as that of the rollers. The profile paths traced by the light beams on the screen projected from the two "eyes" will show an accurately enlarged profile of the cross-section of the blade without error in thickness.

A special unit for checking both sides of a

blade simultaneously has also been developed. This unit has a moving arm on which two sleeves move independently on ball bearings at right angles to the movement of the arm. Both sleeves have rollers for contacting opposite sides of the blade simultaneously, and are moved toward each other under light spring pressure. The spring pressure keeps the rollers in contact with the blade, while the movement of the arm causes them to traverse the entire profile of the blade. The "eyes" on the sleeves of this unit follow the same paths as the rollers.

The vertical and horizontal movements of the members of this unit, as is the case with the others described, are exactly at right angles to each other, and are maintained at 90 degrees with a high degree of precision by employing preloaded ball-bearing slides.

One of the problems to be solved in developing the "Pant-O-Jector" was the provision of some simple means for bringing the work-holding fixture and work, the traversing roll, and the "eyes" all into their proper respective positions for projecting the magnified profile on the screen in proper alignment with the master profile or chart gage lines.

Referring to Fig. 2, the block *J*, attached to the work-holding fixture, has horizontal and vertical faces. These two faces, at 90 degrees to each other, provide definite locating points for the roller *D*. When roller *D* is in contact with these surfaces the "eyes" can be adjusted to bring one of the projected light beams into contact with or tangent to two master setting lines at the upper left-hand corner of the screen, which are also at right angles to each other. When this has been done, the path of the projected light beam will follow the master outline on the screen if the blade has been accurately machined.

The positioning block on the fixture to which the roller is set is generally accurately located with respect to the theoretical center of gravity of the blade. Reference to the views at the right in Fig. 4 will show how the accuracy with which the mounting root of the blade is aligned with the center of gravity of the blade outline can be gaged.

Assuming that the traversing roller has been placed in the set-up gaging block on the fixture and that the "eye" *E* has been adjusted by means of knurled knobs *A* and *B* to bring the projected disk of light *L* into the gaging position, tangent to the lines *M* and *N*, the periphery of the projected disk-shaped light spot *L* should appear to roll along the master profile line *P*, just as the traversing roller rolls along the surface of the blade being gaged.

If, instead of following line *P*, the light spot should trace a patch such as indicated by dotted line *C*, it would appear that the profile of the section being tested, although of the correct shape, were not in the proper position with respect to the root or mounting surfaces of the blade. In order to verify this, the knobs *A* and *B* are adjusted until the "eye" follows path *P*. Thus it is found that the shape of the section is correct, but that the center of gravity is not properly located.

To determine how much the center of gravity is "off location," the roller is dropped back into the original setting block position on the fixture. The projected light disk *L*, instead of being aligned tangent to lines *M* and *N*, has been moved to the left of line *M* and below line *N*. By reading the scales that extend each side of these lines, the number of thousandths of an inch that the center of gravity has been displaced vertically and horizontally can be determined.

Fixtures used for the inspection of finished

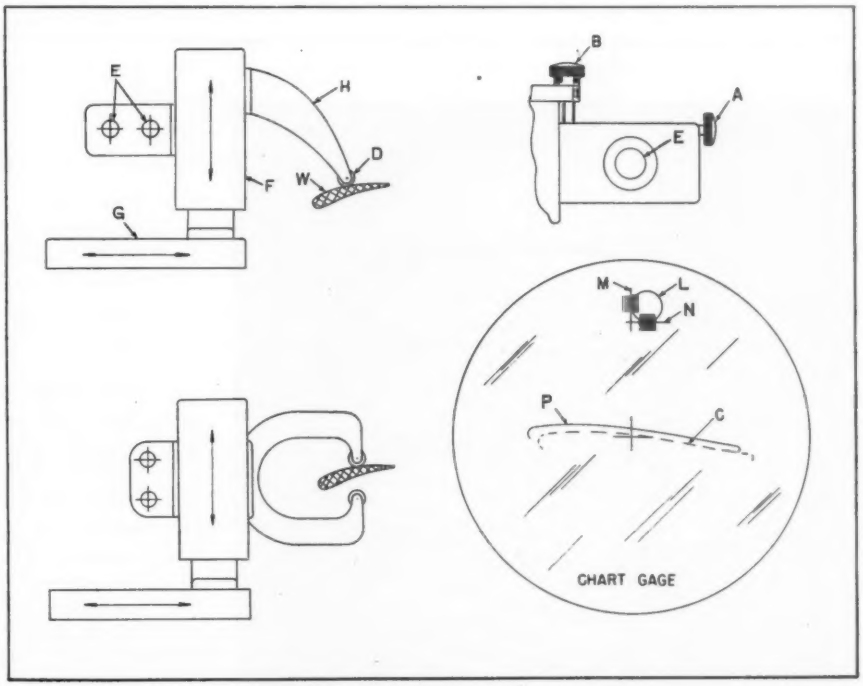


Fig. 4. Diagrams Illustrating Application of "Pant-O-Jector" to the Checking of Jet-propulsion Blades

blades are, of course, designed for faster operation than those intended for analytical work. Production inspection fixtures have provision for rapid and accurate indexing from section to section. Special production inspection units have been built for measuring the profiles of rough forged or cast blades before any machining has been done on the root or dovetail.

Of special interest is a ball-and-socket type of blade-holding fixture designed to facilitate rapid aligning of the rough blade in the correct profile gaging position without consideration of the root location. When thus located, built-in drills in the fixture drill a small center hole in each end of the blade, or in some cases, two center holes in one end and one at the opposite end. These center holes establish the center of gravity of the blade and furnish accurate locating points for all succeeding machining and gaging operations.

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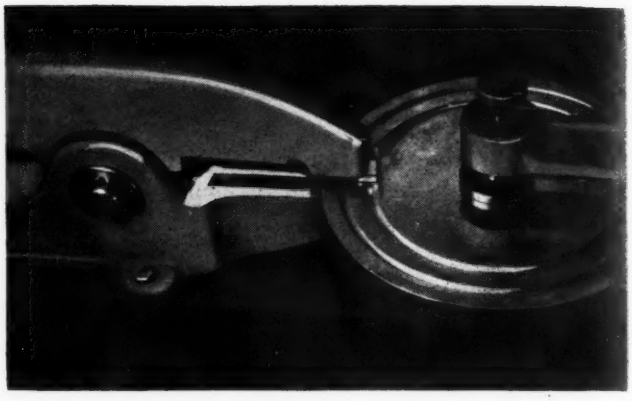
Versatile Sheet-Metal Nibbling and Beading Machine

The accompanying illustration shows one of many interesting operations performed by a versatile sheet-metal nibbling and beading machine known as the "Grampus," which was used extensively in England during the war for small-lot and model or "mock-up" work. The operation illustrated consists of forming concentric beadings on a sheet-metal disk, mounted in such a manner that it can be rotated between the upper and lower beading tools, which are oscillated at high speed by a motor on the machine base.



Forming Concentric Beadings on Sheet-metal Disk by the Use of a "Grampus" Nibbling and Beading Machine

The machine illustrated can be equipped for forming beads of various sizes and shapes in cylindrical, as well as flat, sheet-metal pieces. The Lakeside Engineering Works, California-in-England, Ltd., Longmoor Lake, Wokingham, Berkshire, England, manufacturers of the machine, also furnish this machine with nibbling jaws for use in cutting flat sheet metal into irregular-shaped pieces of any desired contour. Contour cutting or nibbling of cylindrical or other curved sheet-metal parts can also be readily accomplished. For example, it is a comparatively simple matter to cut metal cylinders along scribed profile development lines such as are required for joining two cylinders at right angles to each other or at any other desired angle.

The five "Master-Trays" hung on the Bantam rack conveyor here illustrated each hold about 170 precision gears in easily accessible positions and in such a manner as to afford maximum protection against surface damage, which so often leads to reworking operations, rejections, and resultant delays in delivery schedules. This rack conveyor provides an exceptionally large work-holding surface considering the floor space occupied. The ceiling space between the trays can be varied to suit the material being handled. Roller-bearing wheels with swivels facilitate movement of the unit when loaded to capacity. This conveyor is built by the Rack Engineering Co., 5102 Butler St., Pittsburgh 1, Pa.

Steps to Follow in Pouring Babbitt Bearings

By K. T. MacGILL, Manager, Babbitt and Bearings Division
Joseph T. Ryerson & Son, Inc.

SOME plants that use babbitt in relatively small quantities have difficulty in pouring uniform bearings. While there are many ways in which bearings can be poured, experience has proved that adherence to the basic principles of heat transfer through the bearing shell will result in good bearings, regardless of the particular set-up or method that is followed. The average shop either has or can readily devise the equipment and fixtures required. From this point on, it is necessary to follow only a few fundamental rules:

1. Use new babbitt, made of virgin metal.
2. Clean the shell with a wire torch and a blow-torch.
3. Heat the babbitt to from 850 to 950 degrees F.
4. Have enough metal to pour the entire bearing at one time, and provide risers to take care of metal contraction.
5. Minimize heat loss by locating the bearing shell close to the ladle.
6. Cool bearing with water, starting at the bottom and working up.

It pays to use new babbitt, made of virgin metal. While it might appear that reusing old metal is one way to save on bearing costs, too often dirt or other harmful foreign matter will be included, or the metals, being unlike in analysis, will not produce the dense, close-grained structure required to resist wear. If a sizable quantity of old metal is accumulated, it can be used for pouring secondary bearings, where loads are light and the performance required is less exacting.

Cleaning and Preparing Equipment and Shell

Using a wire brush, clean all equipment, fixtures, and the inside of the shell thoroughly. Follow this with a blow-torch and further brushing, if necessary. The blow-torch also serves to remove all moisture from the bearing shell, which is important. The mandrel should be as thin-walled as possible, with the ends closed by wooden plugs to prevent heat loss.

A waste head on top of the shell takes care of the problem of shrinkage as the bearing solidifies, assuring sufficient metal to fill the bearing area completely. The height of the waste head depends upon the size of the bearing, larger bearings requiring more excess metal at the top to make up for shrinkage.

Before starting to melt, make sure that there is sufficient babbitt to pour the entire bearing at one time; this is necessary in order to secure a dense and completely uniform structure. The melting pot should be placed close to the work to prevent heat loss in the ladle as the molten metal is transferred from the pot to the bearing fixture.

Generally speaking, a pouring temperature of from 850 to 950 degrees F. is sufficient. After the babbitt is completely molten, the best pouring temperature depends on the thickness and size of the bearing being poured. The metal should pour about like water. Heating to a slight excess is not harmful, the only disadvantage being the accumulation of a higher percentage of dross resulting from oxidation.

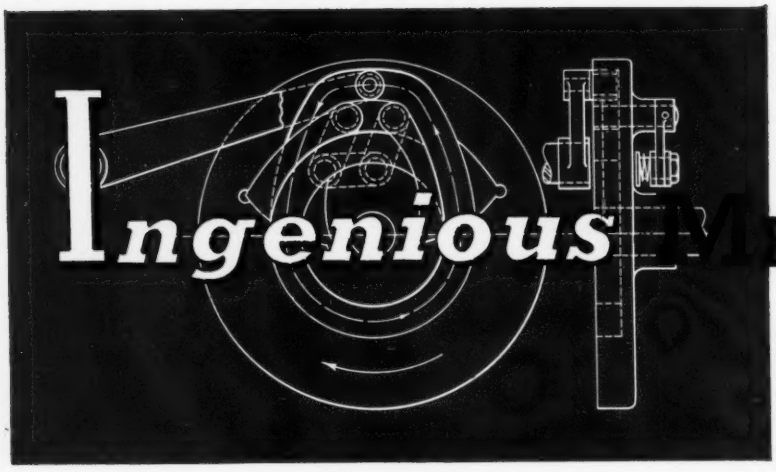
Thick, heavy bearings can be successfully poured at a lower temperature than bearings that are long and thin. The metal must be hot enough to reach the bottom of the mold and start to build up before any sign of setting occurs. One simple method of checking to determine if the metal is at the correct heat is to insert a small, dry pine stick in the pot. It should burst into flame immediately upon contact with the hot babbitt if the heat is correct.

Pouring the Bearing

Before starting the pouring operation, the shell should be warmed to about 200 degrees F. As previously stated, this serves to dry out all moisture and also prevents too quick or non-uniform solidification of the molten metal.

Fill the space completely and as rapidly as possible, continuing pouring until the top of the waste head is reached. Cool the bearing shell by applying water or wet rags, starting at the bottom and working slowly upward. By thus drawing the heat outward, the metal starts to solidify at the inside surface of the shell, adhering tightly to the wall.

While conditions and facilities will vary from shop to shop, the foregoing rules should insure the production of bearings that are sound and capable of giving long, trouble-free service.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Device for Automatic Shifting between Two Cam-Operated Packing Mechanisms

By H. B. SCHELL

In designing a device for disposing of sheets from the delivery end of a paper finishing machine, it was desirable to provide a means of automatically and periodically shifting from one cam-operated packing mechanism to another. The shifting device here described permits five hundred sheets of paper to be placed on one tray while a second full tray adjacent to it is being replaced with an empty one.

Referring to the illustration, arms *A* and *B*, which are actuated by cams *C* and *D*, are secured to and alternately rock their respective pivot shafts A_1 and B_1. Each pivot shaft is connected to a separate packing mechanism (not shown).

One arm rocks its pivot shaft five hundred times, whereupon it stops at the top of its stroke and the other arm immediately begins its cycle of five hundred strokes. The working stroke occurs when the follower of the arm rolls into the hollow of its respective cam. The cams are secured to shaft *E*, which rotates continuously at one revolution per cycle of the finishing machine.

A plate *F*, equal in diameter to the cams, is located between them and slides back and forth on a key in shaft *E*. When this plate is in contact with either cam, the follower is prevented from rolling into the hollow of that cam and is held at the top of its travel. Meanwhile, the follower on the other arm is free to roll into the hollow of its cam and thus rock its pivot shaft. Upon completion of the cycle of five hundred strokes, plate *F* is shifted from one cam into contact with the other, thus shifting the packing cycle from arm *A* to arm *B*, or vice versa.

This shifting is accomplished by means of drum cam *G* and notched disk *H*, which are both pinned to shaft *J*. The follower carrier *L* for the drum cam is pinned to sliding shaft *K*, while block *M* and compression springs *N* and *P* are free to move on this shaft. The follower carrier and block *M* are both free to slide on the parallel shaft K_1, which is secured to the frame of the mechanism.

Two notches, 180 degrees apart, in hardened disk *H* provide a sliding fit for the lower portion of block *M*, which is square in cross-section and also hardened. As the drum cam revolves in the direction indicated by the arrow, with the parts of the mechanism in the relative positions shown, the follower will be forced to move to the left. This rotation will prevent block *M* from moving to the left and entering the notch in the top of disk *H*. Thus, compression spring *N* will become loaded during a half revolution of the drum cam.

At this point, the second notch, shown at the bottom of disk *H*, becomes aligned with the block. Spring *N* then unloads, moving the block through the notch and thus rotating bellcrank *Q*, one arm of which is pinned to the upper portion of the block. The other arm of this bellcrank is provided with a follower located between the flanges of spool F_1. The spool is connected to plate *F* by three rods, which run through cam *D*. Thus, the rotation of the bellcrank causes plate *F* to be shifted from one cam to the other.

Further rotation of the drum cam brings block *M* into contact with the opposite side of disk *H*, thus loading spring *P*. When the block reaches alignment with the notch shown at the top of the disk, it will pass through the disk, thus turning bellcrank *Q* in the opposite direction and again shifting plate *F*.

The purpose of the gearing at the right-hand end of shaft *J* is to turn this shaft one revolution for every thousand revolutions of shaft *E*. One revolution of shaft *J*, as previously explained, imparts two shifts to plate *F*, thus resulting in

Packing Action is Alternately Transferred between Mechanisms on Pivot Shafts A_1 and B_1 by Means of This Automatic Shifting Device

the desired packing of five hundred sheets in each tray.

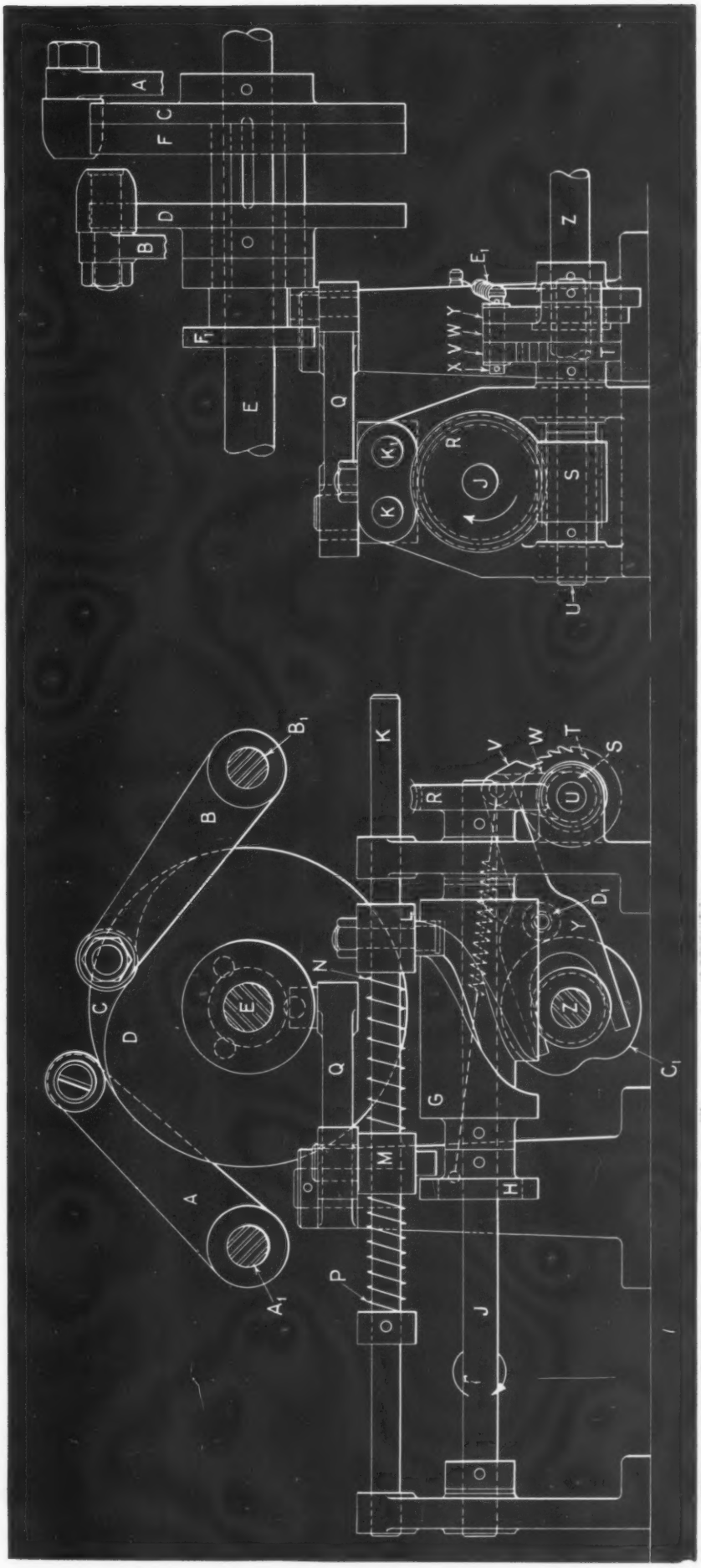
Worm-wheel *R*, which is pinned to shaft *J*, meshes with worm *S*. This worm and ratchet *T* are pinned to shaft *U*. The ratchet is driven by pawl *V* through arm *W*, which turns freely on shaft *U*. In the outer end of arm *W* is securely fixed a pin *X*, which serves as a pivot for the pawl and cam-follower yoke *Y*.

Cam C_1 is secured to shaft *Z*, which rotates at the same speed as shaft *E*. Roller D_1, which is held in contact with this cam by spring E_1, is fastened to yoke *Y*. One tooth of ratchet *T* is thus indexed per revolution of shaft *Z* or *E*. The number of teeth on ratchet *T* and worm-wheel *R* is such that shaft *J* will make one complete revolution for every thousand revolutions of shaft *Z* or *E*.

Mechanism for Retarding an Automatic Feeding Device

By VINCENT SANTACATERINA
Tool Engineer
Electra-Voice Corp., Chicago, Ill.

A two-stage forming die with an automatic feed is used to form flanges on a relay armature in two different directions. A 1-inch feed on a 2-inch stroke punch press is used for this operation. Only the last 15/32 inch of travel of the 2-inch stroke does the forming. It was necessary, therefore, to retard the automatic feed caused by the 2-inch stroke of the press. This was accomplished by the mechanism here illustrated. This



retarding mechanism keeps the feeding device stationary during the forming operation.

When the punch has completed 1 17/32 inches of its travel, bellcrank *H* halts on the head of stop-screw *K*, as shown at the left in the illustration. However, the punch continues its travel, and completes the forming operation. As shown at the right in the illustration, when the punch moves up and the bellcrank is lifted off the stop-screw, pawl *M* turns ratchet *N*, thereby feeding a new part into the first stage of the die, moving the partially formed part from the first to the second stage of the die, and pushing a completed part out of the die.

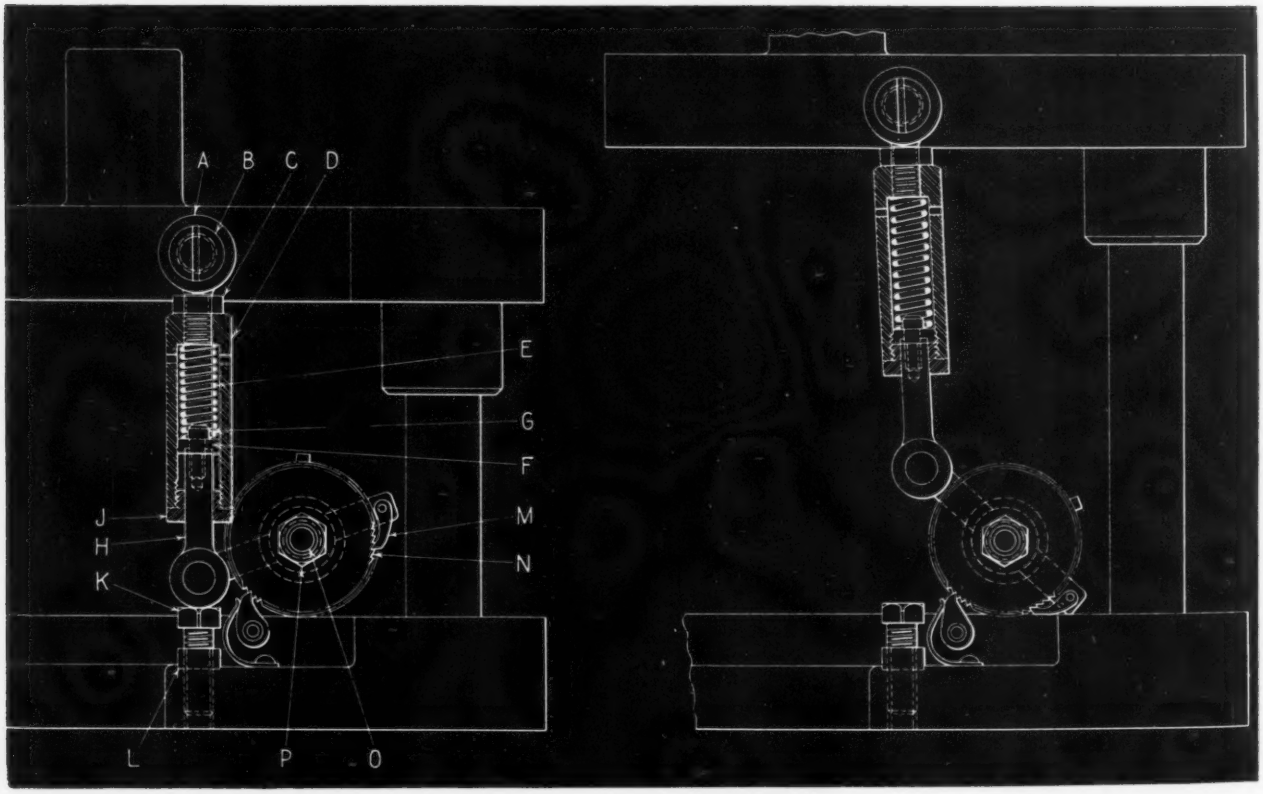
The mechanism was assembled by fastening eyebolt *A* to the punch-holder with screw *B*. Lock-nut *C* and spring-housing *D* were threaded onto the eyebolt. A threaded bushing *J* was placed over one arm of the bellcrank *H*. The end of this arm of the bellcrank was fitted with a spring support bushing *F*, held to the bellcrank by cap-screw *G*. A pawl *M* was pinned to the other arm of the bellcrank. Spring *E* was placed in the housing *D*, and then the bellcrank assembly was fastened to this housing by means of threaded bushing *J*.

The arm of the bellcrank that holds the pawl was fitted over drive-shaft *O* of the feeding device. This arm and ratchet *N* were retained on the drive-shaft by means of nut *P*. Drive-shaft *O* was attached to the die-holding surface of the die set. Stop-screw *K* was threaded into the base of the die set. Lock-nut *L* is used to secure the stop-screw in the desired position after adjustments have been made.

* * *

Awards Presented at Annual Meeting of American Welding Society

A number of awards were made at the annual meeting of the American Welding Society, recently held in Atlantic City. The Samuel Wylie Miller Memorial Medal was awarded to James F. Lincoln, president of the Lincoln Electric Co., because his "belief in the value of electric arc-welding has led him to most effective promotions of its use." Julius Heuschkel, research engineer, Westinghouse Research Laboratories, East Pittsburgh, Pa., was awarded first prize in a contest sponsored by the Resistance Welder Manufacturers Association; Joseph J. Riley, sales engineer of the Taylor-Winfield Corporation, received second prize; while a third award went to Robert W. Bennett and Robert D. Williams. The A. F. Davis Undergraduate Welding awards were also presented to authors and publications for articles on welding.



View at Left Shows how Bellcrank H is Halted by Head of Stop-screw K as Punch Descends. As Shown at Right, when Punch Ascends Pawl M Turns Ratchet N, thus Operating the Automatic Feed of the Punch Press

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Helical Forming of Strip Stock without Tearing the Edge

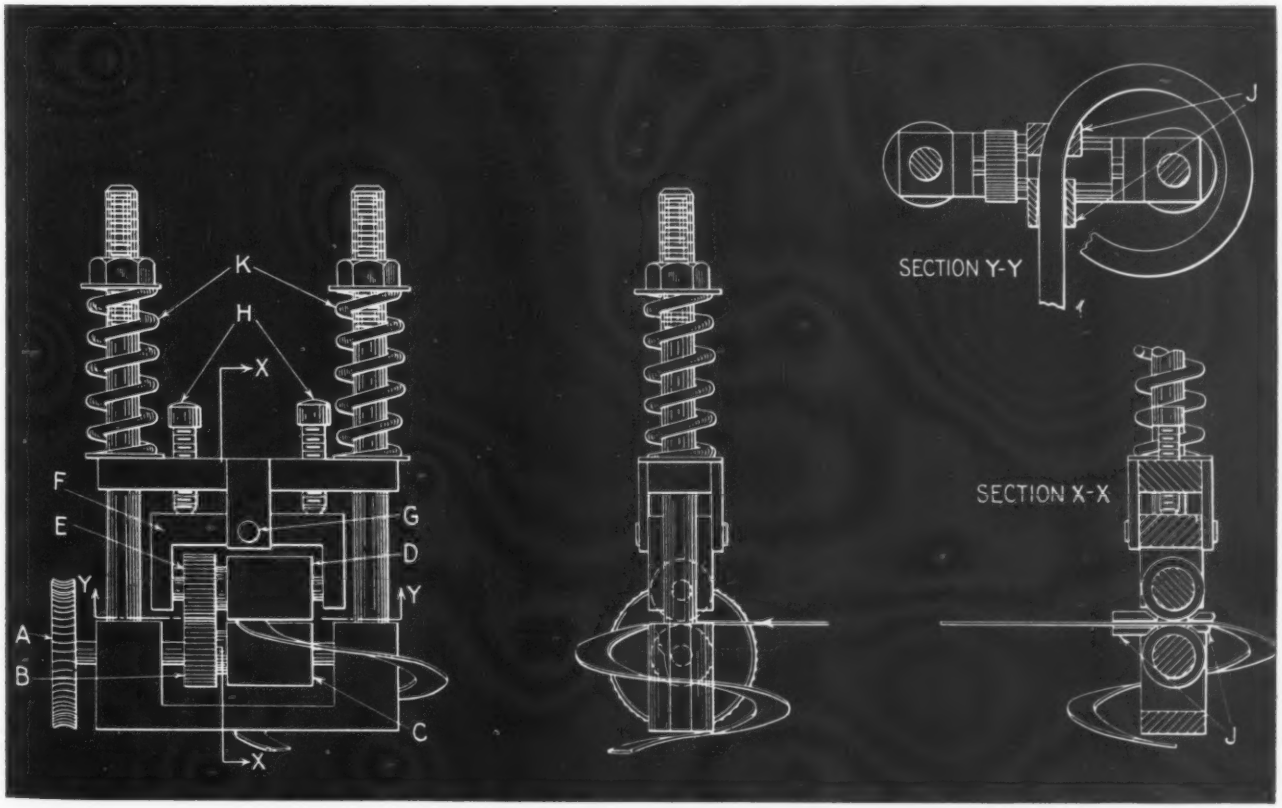
By PHILIP B. EDWARDS
Great Neck, Long Island

Laminations consisting of stacks of flat, thin rings are often used for cores of electrical components where eddy currents are to be reduced and for other applications requiring diametral rigidity. Such rings can be punched from flat sheets. This method, however, is costly, since the metal cut from inside and around the rings is scrap. The process also involves the use of a punch press and compound dies.

An effective, more economical, and easily formed lamination for such purposes is the helix here described. The helices are formed from flat strip stock by means of the mechanism shown in the accompanying illustration. Such helices are consolidated into a solid stack by placing in a jig under slight compression, painting with a thermosetting resin cement which will seep into the interstices, applying more pressure, and baking to harden the cement.

Strip stock is generally formed into helices by winding the material edgewise over a rotating mandrel. However, if the diameter of the helix is small relative to the thickness of the material, or if the material being formed is not sufficiently malleable, tears may occur in the outer edge of the helix. The mechanism and method here described permit the forming of helices without tearing.

The mechanism consists essentially of a pair of rollers *C* and *D*, with their left-hand ends in contact and their right-hand ends slightly sep-



Mechanism for Helical Forming of Strip Stock. The Angle between Rollers C and D and the Tension of Springs K are Adjustable to Provide Helices of the Desired Diameter

arated. The strip stock to be formed into a helix is fed between these rollers. As the rollers turn, they pull the thin metal through the wedge-shaped space, thus exerting more pressure on one edge of the strip than on the other. The edge of the strip that is compressed the most becomes longer, thus bending the strip at a constant rate toward the least compressed edge and forming a helix.

Worm *A*, which is driven at 80 R.P.M., transmits motion to gear *B* and roller *C*, mounted on the same shaft. Gear *B* meshes with gear *E*, thus causing roller *D* to rotate. The shaft on which gear *E* and roller *D* are mounted is supported in yoke *F*, which can be pivoted about pin *G*. Adjustment of the angle between the rollers is accomplished by means of the two screws *H*, which act on yoke *F*. The pressure on the metal being formed is applied by the springs *K*, the tension of which is adjustable. The constant pressure exerted by these springs compensates for any differences in the thickness of the strip stock or variations in the diameters of the rollers.

The proper combination of angle between the rollers and spring tension provides a helix of the desired diameter. The two guides *J*, shown in sections *X–X* and *Y–Y*, are used to position the strip rigidly at one location between the rollers, thus insuring uniformity of helix diameter. These strip-positioning guides have been omitted from the front and side views of the mechanism for clarity. In operation, the guides are rigidly held by arms attached to the stationary frame of the mechanism.

Differences in thickness between the outer and inner edges of the formed material are unavoidable, regardless of the forming method used, unless strip stock with a wedge-shaped cross-section is used. With such material, it is possible to employ a pair of parallel rollers to form a helix with a flat cross-section.

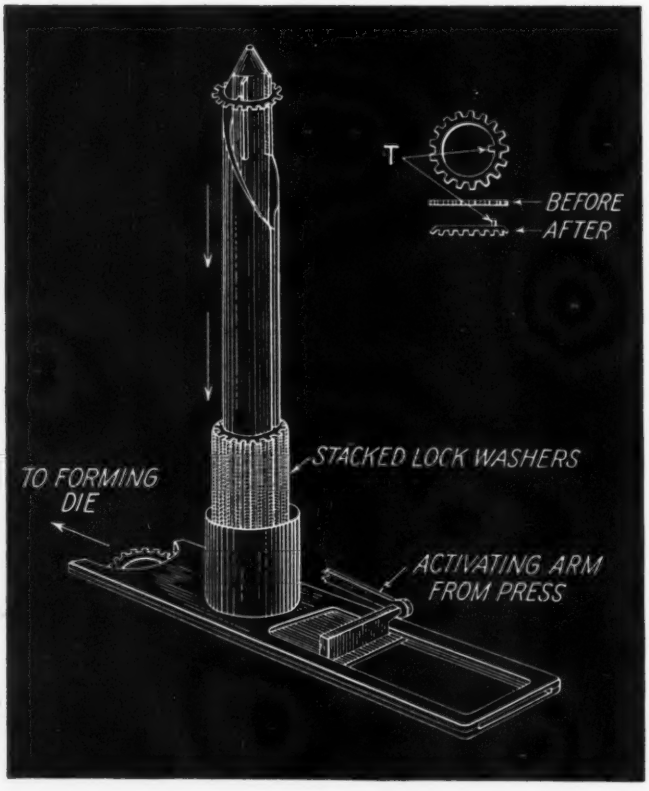


Fig. 1. Device for Indexing, Locating, and Feeding Lock-washer Blanks to the Forming Die of a Stamping Press

Device for Indexing, Locating, and Feeding Lock-Washer Blanks

By J. W. GULLIKSEN and J. W. HILLHOUSE
Worcester Pressed Steel Co.
Worcester, Mass.

In feeding lock-washer blanks into the forming die of a stamping press, it is necessary to index the blanks so that they will be fed with their internal tabs in the proper location, as the die contains a slot to receive this tab and form it to a right angle. The simple device here described allows the lock-washer blanks to be indexed, located, and fed for such an operation. A lock-washer blank, before and after the forming operation, is shown in the upper right-hand corner of Fig. 1. The locating tab which fits into the slot of the forming die is indicated at *T*.

Referring to Fig. 2, floating arbor *A*, on which the lock-washer blanks are stacked, consists of a slotted tube with a plug in each end. The upper end of the tube is cut to a helical form, as shown at *Q*. The upper plug is provided with a blunt point and two leader fins *F*, which centralize the blanks.

Housing sleeve *S*, which is provided with a vertical key *K*, is located in a fixed position in base *B*, over slide table *C*. Opening *O* is of sufficient depth to permit the feeding of only one blank at a time.

In operation, blanks placed at random over the arbor are centralized by the fins, indexed to the proper radial position by rotation caused by the helical edges of the tube acting on the tabs, and aligned by the tabs engaging groove *G* as the blanks fall down the arbor. When the blanks enter the sleeve a key *K* engages an external notch to keep the blank properly located. A stack of blanks in the sleeve keeps the arbor central.

Pusher *P* reciprocates horizontally through opening *O*, actuated by each stroke of the press. As *P* pushes against the outer edge of the blank, the rounded end of the lower arbor plug is lifted on the blank, thus permitting the blank to be advanced to the forming die. When the pusher is returned to its original position on the reverse stroke, the arbor again falls onto the slide table. This rise and fall of the arbor assists the feeding operation by preventing the blanks from sticking to the arbor.

* * *

Compulsory Arbitration Advocated by Cutting Tool Manufacturers' Association

A labor program designed to eliminate strikes by calling for compulsory arbitration of grievances, legislation to equalize the position of management and unions at the bargaining table, and Government seizure on negotiation cases where necessary to protect the public interest was adopted at the recent annual meeting of the Cutting Tool Manufacturers' Association in Detroit. The three basic provisions are:

1. Adoption of legislation making it possible for employers to come to the bargaining table on an equal footing with unions.

2. Setting up of special labor courts to hear appeals on grievance cases. The decision of these courts would be binding on both parties and would tend to eliminate all strikes due to grievances.

3. Setting up of special wage courts or commissions to hear and issue decisions on appeals regarding wage disputes and other questions subject to negotiation. While the decisions of these courts or commissions would not be binding, they would pave the way to Government seizure of a plant where the public interest is involved. Legislation to permit such seizure is advocated by the Association.

The new officers elected at the meeting are: President, E. A. Goddard, vice-president of the Goddard & Goddard Co., Detroit, Mich.; vice-president, D. E. Van Deusen, president of the Kelly Reamer Co., Cleveland, Ohio; and treasurer, R. H. Wolfe, president of the Arrow Tool & Reamer Co., Detroit.

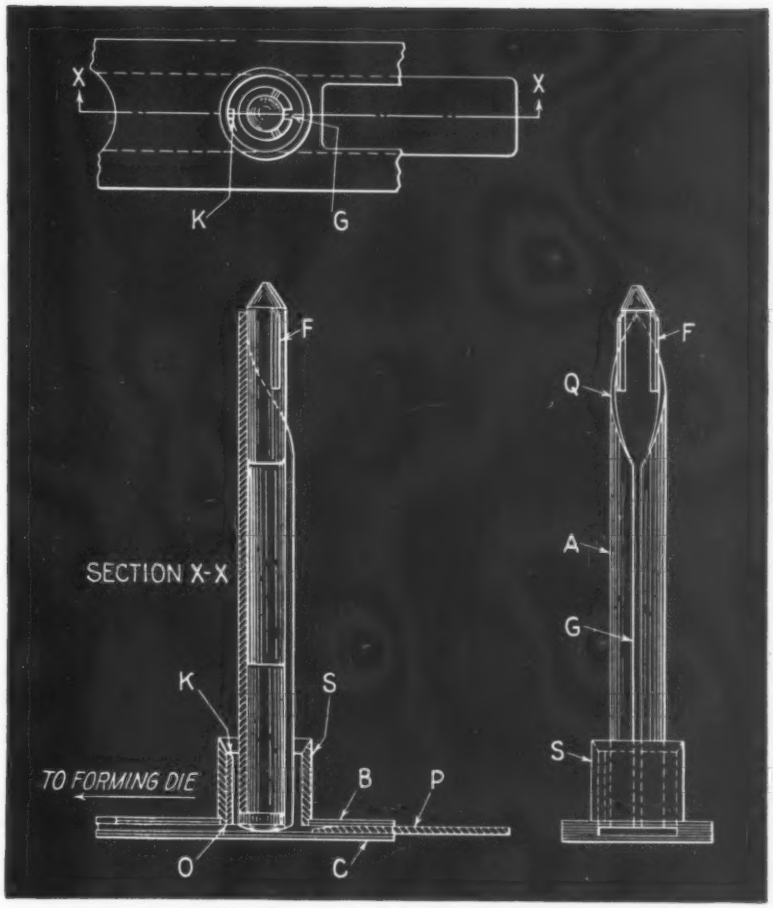


Fig. 2. Details of the Feeding Device Shown in Fig. 1. The Internal Tabs of the Lock-washer Blanks are Kept in Alignment by Groove G in Arbor A

New Lincoln Arc-Welding Award Program

The James F. Lincoln Arc Welding Foundation announces a new $200,000 Design-For-Progress Award program. Cash awards ranging from $100 to $13,200 will be given for papers or reports on the design or redesign of machines or structures for welding, the operation of a job weldery, welding in maintenance service, or education in welding. Three of the classifications cover functional machinery, industry machinery, and personal service machinery. The functional machinery classification is further subdivided under metal-cutting machinery; metal-forming machinery; electrical machinery; prime-moving machinery; conveying machinery; and pumping and compressing machinery. There will be twenty-eight awards under the functional machinery classification totaling $15,400. The three main awards of the program amount to $22,500.

Further information on the closing date and other regulations concerning the contest can be obtained from the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Compound for Use in Drawing and Stamping Operations

A new drawing compound, known as Texaco drawing compound No. 2, has been perfected by the Texas Co., 135 E. 42nd St., New York City. The new product is adapted particularly for use in stamping and drawing operations. It has a paste-like consistency, and is easily washed from a completed piece with water. 201

High-Speed Steels Without Carbide Segregation

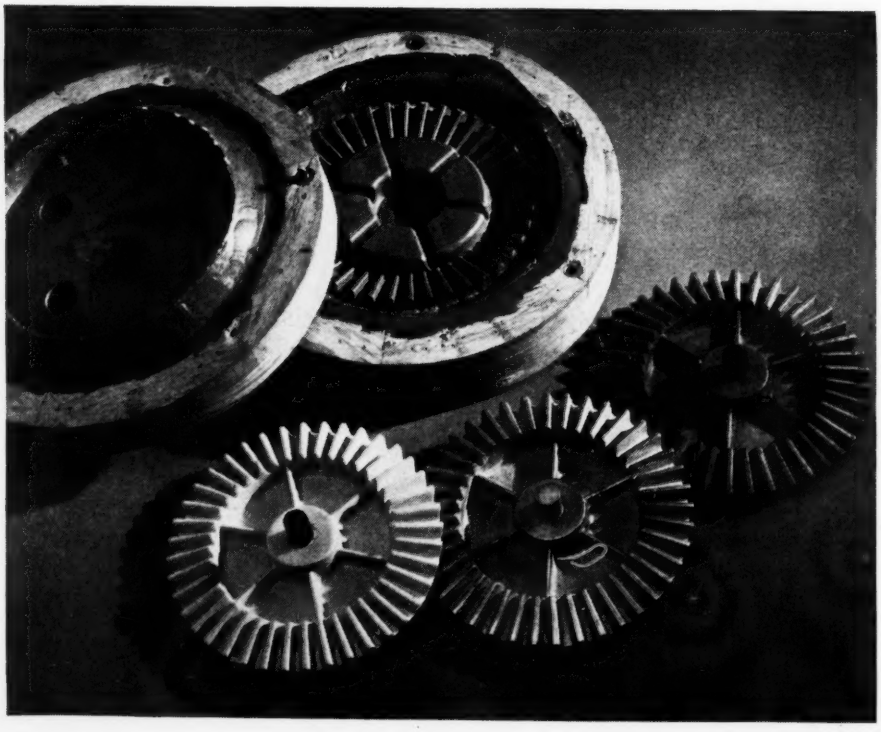
The Jessop Steel Co., Washington, Pa., in collaboration with the Barium Steel & Forge Co., Inc., Canton, Ohio, have announced a new method of processing high-speed steel rounds in diameters greater than 4 inches. This process is known as "Vee-Oginizing."

Jessop "Vee-Oginized" high-speed steel rounds in the larger diameters are free from the central carbide segregation common to high-speed steels as usually processed. The uniform carbide distribution eliminates the brittle carbide pattern found in large rounds of high-speed steels processed by conventional methods. 202

Two New Low-Temperature Silver Brazing Alloys

In view of the increased price of silver, two new silver brazing alloys featuring lower silver content, announced by Handy & Harman, 82 Fulton St., New York 7, N. Y., are of interest. These alloys are called "Easy-Flo 45" and "Easy-Flo 35." The former contains 45 per cent silver, as well as copper, zinc, and cadmium. One of its exceptional features is a low melting range of 1120 to 1145 degrees F. The joints produced between ferrous, non-ferrous, and dissimilar metals are strong, ductile, and leak-tight.

"Easy-Flo 35," which contains 35 per cent silver, has characteristics quite different from the 45 per cent alloy. It has a wider melting range—1115 to 1295 degrees F.—and is free



In the Foreground from Right to Left are Shown a Wood Pattern, an Aluminum Pattern, and a Durez-casting Resin Pattern for a Bevel Gear. In the Background is a Plaster Mold in which the Durez Pattern was Cast. Considerable Savings in Time and Material are Claimed when Durez Casting Resin—a Product of Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. —is Employed

flowing at an exceptionally low temperature for an alloy containing 35 per cent silver. It offers an opportunity for manufacturers to economically produce joints between ferrous or non-ferrous metals which are high in strength and ductility, and is suitable for use in places where a higher working temperature is not objectionable. 203

Silicone Resin Forms Base of Heat-Resistant Paints

A thermosetting silicone resin has been developed by the Dow Corning Corporation, Midland, Mich., for use in formulating exceptionally heat- and moisture-resistant paints having a hard mar-resistant surface. This new resin, known as "DC 804," is especially suitable for producing white finishes having properties between those of ceramic coatings and ordinary organic paints. Such finishes, when made with DC 804, do not become yellow or chalky with age because of the exceptional resistance of this silicone resin to moisture, oxidation, ozone, and ultra-violet radiation. 204

Plastic Protective Compound is Easily Applied and Removed

A coating that provides protection from moisture, acids, and alkalis, and that can be applied at room temperature to a product by either dipping or spraying, has been placed on the market by the Puritan Co., Inc., Rochester 6, N. Y. The new coating, known as "Plastipak" is a resinous compound that dries quickly in air and forms a tough, elastic transparent or colored film. It adheres tenaciously to the product to which it is applied, but can be easily stripped off in one continuous sheet when desired. "Plastipak" has been applied successfully to cutting tools, gears, drills, taps, and sheet metal, as well as to wood products, glass, and porcelain. In actual tests, the coating shows no deterioration after exposures of long duration and retains its transparency remarkably well. 205

Cold-Run Resin Glue Can be Worked in Twenty Minutes

A cold-run, fast-setting resin wood glue that requires no heating, known as "Wood-Lok," has been developed for joint assembly operations by National Adhesives, 270 Madison Ave., New York 16, N. Y. The new glue can be handled and machined after twenty to thirty minutes' clamping time, instead of having to wait the usual six to eight hours. Exhaustive tests have shown that it produces a strong, resilient bond for wood joints that is unaffected by humidity. It is supplied in liquid form, and has a working and storage life of several months. 206

Protective Degreaser of the Emulsifying Type

An emulsifying degreaser, known as "G-Bex D," has been made available by the Gaybex Corporation, Nutley 10, N. J. "G-Bex D" is a neutral emulsifying solvent having a minimum flash point of 165 degrees F. (A.S.T.M. C.O.C.) that will hot strip paint or lacquer. It can be used for light or heavy degreasing by spray, brush. or soak application, followed by a water rinse.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

It is not irritating to the skin and is non-corrosive to all standard construction metals.

Tests have indicated that steel bearings and parts can be handled without the formation of finger prints after being cleaned with "G-Bex D" and water rinsed. The slight protective film remaining after the wash lasted for several months. 207

Highly Stable Adhesive Has Wide Industrial Application

A new industrial adhesive known as No. 4665 cement, that requires no catalyst or special preparation for use has been announced by E. I. du Pont de Nemours & Co., Wilmington 98, Del. This adhesive is described as being tough and flexible, suitable for bonding metal foils and metal sheets to wood, plastics, vulcanized synthetic and natural rubbers, as well as to other substances having widely different coefficients of thermal expansion. It can be applied without thinning by brushing, roller coating, knife coating, or dipping. Although insoluble in water, its bond strength is lowered by continued immersion. However, the bond strength is regained after removal from water. It has a six-months' minimum package stability with no tendency to gel inside of a year.

The dried adhesive film is resistant to dilute alkalis, acids, and corrosive salt solutions. It is not attacked by petroleum or coal-tar solvents, lubricating oils, alcohols, ethylene glycol, or vegetable oils, but is soluble in ketones or ester solvents. Moreover, the cement is resistant to mildew and fungi. 208

Free-Machining Die Steel Made by Vanadium-Alloys Steel Co.

"Speed-Cut"—a new die steel produced by Vanadium-Alloys Steel Co., Latrobe, Pa.—has characteristics that make it particularly adapted for plastic molds and for die-casting dies for white metal alloys. The novel feature of this steel is its free-machining quality, which permits hardening the steel prior to machining. The steel is furnished in the annealed state or heat-treated within the range of 250 to 325 Brinell, as specified.

The new die steel is said to machine as readily at 300 Brinell as other steels used for the same purpose in their annealed state. Die-casting dies formerly used in the annealed condition because of the high costs of finishing after treatment, can thus be replaced with a steel of high hardness, better capable of resisting abrasion and other operating hazards. 209

Veeder-Root Holds Open House in New Factory Building

A new factory building comprising 40,000 square feet, which has just been completed by Veeder-Root, Inc., Hartford, Conn., brings the total floor space of the company's Hartford and Bristol plants to 295,000 square feet—an increase of 180,000 square feet within the last twelve years. The completion of this new three-story building was celebrated December 14 to 17 with an open house for the employes, customers, and general public.

There was a comprehensive exhibit of the products made by the company and of the many ways in which Veeder-Root counting devices are used in the products of other companies, such as gasoline pumps, addressing machines, machine tools, juke boxes, airplanes, radar equipment, electric typewriters, and so on. More than seventy such products exhibited came from all sections of the country.

Two applications of especial interest to engineers in the metal-working field were a Pratt & Whitney Electrolimit gage designed to maintain a constant check on the output of rolling mills, and a head for a Milwaukee "Midgetmill." On the Electrolimit gage, a Veeder-Root counting device indicated directly any variation in the thickness of the stock both under or over size, while on the milling machine head the counting device, referred to as a "Thou-Meter," registered any movement of the spindle gear in either direction, directly in thousandths of an inch. There was also a punch-press safety guard with an integral counting device.

One section of the exhibit included counting devices that were used in weapons, such as machine guns, buzz bombs, and fire controls, during the last war. Another section showed the detail parts from which the counting devices are assembled. There was also a historical display, in which were shown cyclometers of many types made in the nineteenth century. Some of them were gold-plated. These cyclometers were originated by the Veeder Mfg. Co., which was established in 1895 and merged with the Root Co. in 1928, the latter concern having been founded in 1866.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

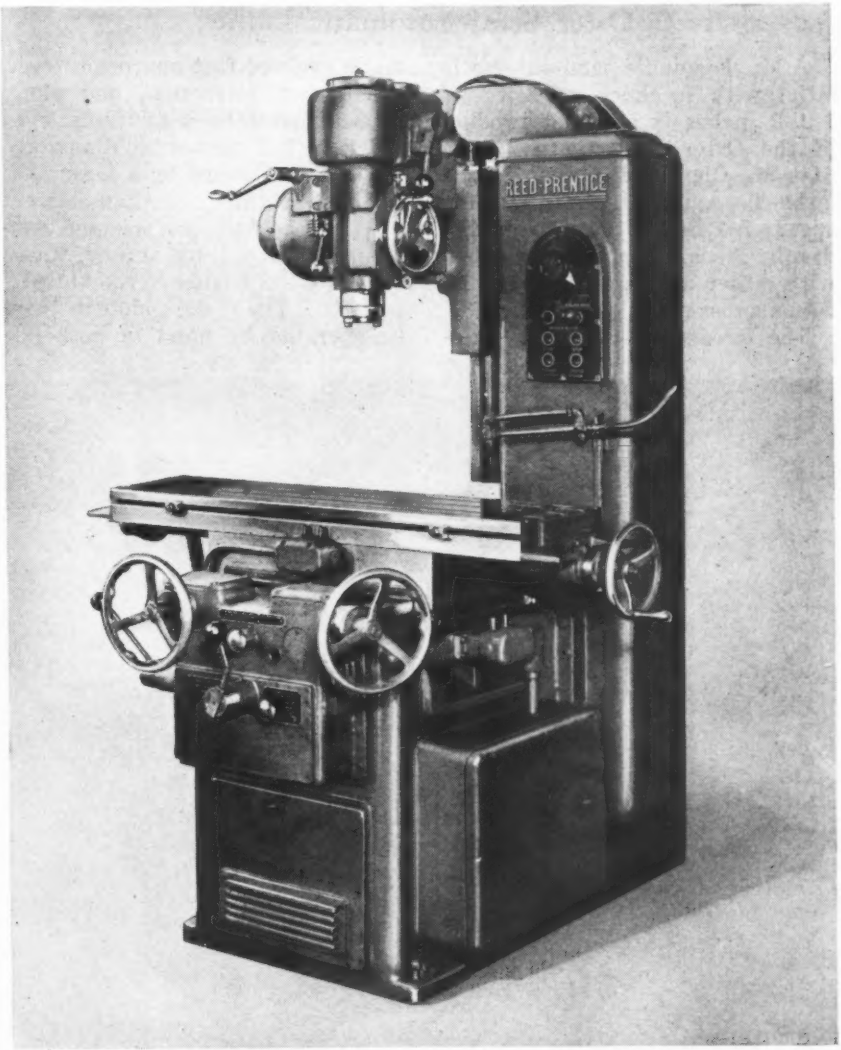
Reed-Prentice Milling and Die-Sinking Machine

Electronic control and a universal head are outstanding features of a vertical milling machine of entirely new design brought out for tool-room work by the Reed-Prentice Corporation, Worcester 4, Mass. The new machine is especially adapted for use in making plastic and rubber molds, die-casting dies, forging dies, and jigs and fixtures. Its universal head, centralized control panel, and infinitely variable feeds and spindle speeds are all designed to facilitate such operations as die-sinking, duplicating, boring, drilling, and face or straddle milling. Greater speed and accuracy, wider range and versatility, and minimum set-up and maintenance time are some of the advantages claimed for this machine.

Construction features include a quill type milling and boring head, mounted on an adjustable ram. Spiral-bevel gears are used to provide smooth, quiet power transmission to the spindle. The cross and longitudinal ways and feed-screws are automatically lubricated by a one-shot system, and are protected from chips and dirt. All gearing is centrally located at the front of the machine and readily accessible by the removal of one panel. A built-in arrangement provides for chip removal from the table ways. The head is counterbalanced on the vertical saddle to insure easy, accurate operation. A pad is provided on the head for the mounting of shaping or high-speed milling attachments. Provision is also made for mounting a flywheel on the spindle at any time to adapt it for use with tungsten-carbide cutters.

Among the features especially designed to facilitate the handling of difficult machining operations are head mounted on sliding ram, which can be adjusted to all angles up to 45 degrees front to back and 30 degrees left to right. The ram can also be depressed to bring the arbor into a horizontal position for milling operations. All push-buttons for speed and feed controls are contained at a single station mounted on the front of the machine column. Two levers control the direction of the feed and rapid traverse movements of the table, front and back or right and left. A Reeves drive and one back-gear provide stepless adjustment of the spindle speed. Automatic adjustable feed-stops are provided for the table, cross-saddle, and vertical saddle.

The electronic drive provides a feed range of approximately 100 to 1; namely, from 1/4 inch to 24 inches per minute for the table and saddle, and from 5/32 inch to 16 inches per minute for the ram. A one-step rapid traverse move-



Tool-room Milling and Die-sinking Machine Brought out by the Reed-Prentice Corporation

To obtain additional information on equipment described on this page, see lower part of page 228.

ment is also provided. The electronic unit is of the constant-torque, half-wave rectification type and has current limiting, dynamic braking, and no-voltage release circuits. The reversing motor is operated by five-position levers, which control the feed and traverse in both directions and provide a neutral position. Feed rate adjustments can be made while the machine is in operation through a potentiometer knob, which permits quick selection of the most efficient feed rate. A readily accessible switch on the column permits the whole machine to be quickly shut off. The magnetic control panel and electronic unit are mounted in compartments that protect them against dust or mechanical injury.

The table has a working surface of 12 by 46 inches, and is provided with three 11/16-inch slots. It has a longitudinal-feed range of 28 inches and a cross-feed range of 12 inches. Both cross and longitudinal feed-screws are equipped with micrometer dials having 0.001-inch graduations.

The maximum vertical distance from the table to the spindle face is 18 inches, and from the spindle to the column 26 inches. The minimum distance from spindle to column is 12 inches. The spindle is 4 inches in diameter at its largest portion, and has stepless speed adjustments through a range of 90 to 2200 R.P.M. It has a vertical travel range of 5 inches, and can be tilted 45 degrees front to back and 30 degrees left to right. The nose is arranged for a No. 40 NMTBA taper. The spindle is driven by a 3-H.P. alternating-current motor, and the feed mechanism by an electronically controlled 1-H.P. motor. 61

Oster Semi-Automatic Lathe

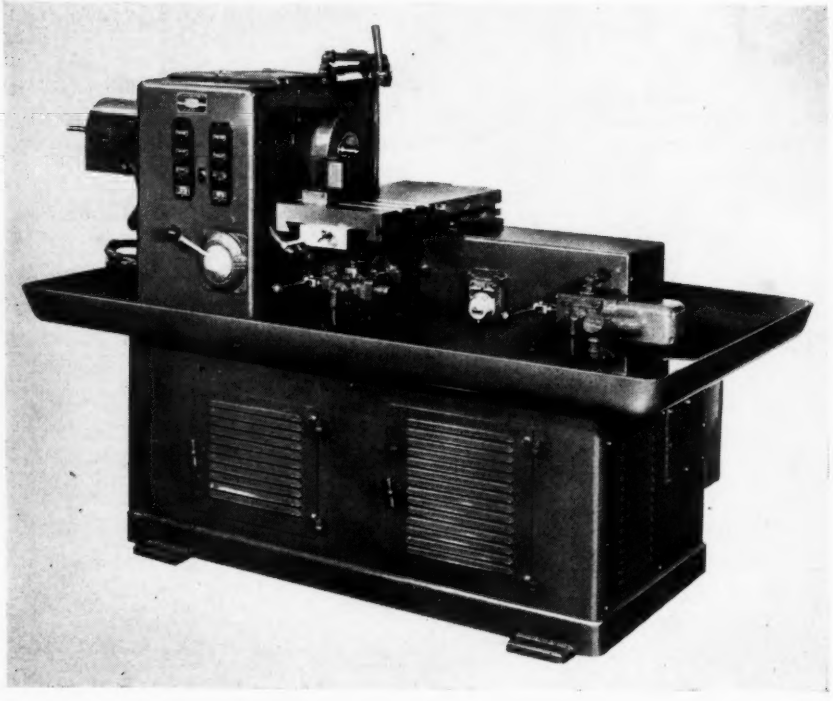
A single-spindle semi-automatic lathe with a chuck capacity of 1 1/2 inches is a recent product of the Oster Mfg. Co., 2073 E. 61st St., Cleveland 3, Ohio. This lathe is equipped with a four-speed, 7 1/2-H.P. motor and hydraulic feeds. It can be furnished with either a single- or a double-action cross-slide.

The cross-slide has an automatic cycle of fast approach, feed, dwell, fast retraction, and stop. It is actuated by a hydraulic cylinder, 3 1/2 inches in diameter, which is controlled by a lever and solenoid-operated valve. In setting up the machine, the solenoid can be disconnected by simply turning a control button to the "hand" position. The cross-slide can then be operated by hand in both directions. Automatic operation of the cross-slide is obtained by simply turning the button to the position marked "automatic."

The hydraulic pump and its 2-H.P. motor and main relief valve mounted in the machine base are easily accessible through a door. The motor is controlled through a magnetic switch actuated by a "start-stop" push-button.

The ball-bearing spindle has a flange type American Standard 6A1 nose for mounting a collet head or other work-holding device. It is equipped with a push-out or draw-back collet, operated by a hydraulic cylinder. The automatic chuck used on this machine is provided with a draw-back collet having an adjustable work-stop in the spindle. The hydraulic cylinder for operating the collet has a 2-inch bore and a 2 1/4-inch stroke. The centrifugal type coolant pump, with which the machine is equipped, is driven by a 1/8-H.P. motor, controlled by the push-button station that controls the hydraulic pump motor.

The machine is regularly furnished with motors, controls, and related equipment, but without tools. It weighs about 3000 pounds, and is 50 inches high, by 44 1/2 inches wide, by 79 inches long...62



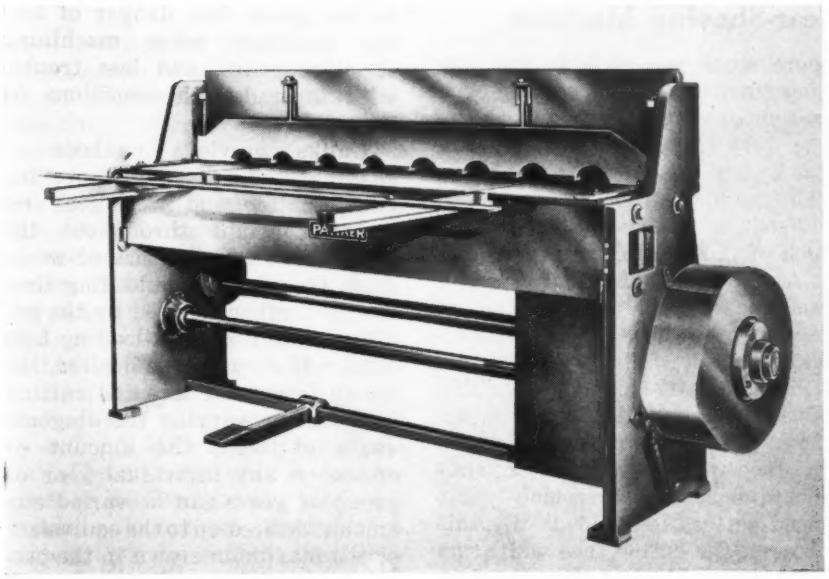
Single-spindle Semi-automatic Lathe Built by the Oster Mfg. Co.

Parker Power Squaring Shears

A new line of power squaring shears built from extra heavy steel plate, welded and normalized to relieve stresses, has been introduced on the market by the Parker Mfg. Co., 2200 Colorado Ave., Santa Monica, Calif. These shears have been designed to combine maximum strength with minimum deflection, and will perform all types of shearing and trimming operations on mild-steel sheets of any thickness up to 14 gage.

The four-way, high-carbon tool-steel blades, secured by extra long gib ways, have been designed to insure long blade life, reduce grinding time, and obtain straight line shearing. Drawn or folded metal parts can be cut with these shears as close as 1 1/2 inches to the shoulder. The blade is 75 inches long, and has a cutting length of 73 inches. The back gage has a range of 18 inches, and the front gage a range of 38

To obtain additional information on equipment described on this page, see lower part of page 228.



All-steel Power Squaring Shears Built by the Parker Mfg. Co.

inches. The 2-H.P. motor furnished with each press gives an operating speed of 85 strokes per minute. The machine has an overall height of 47 inches, requires a floor space of 72 by 102 inches, with front and back gages, and weighs about 2750 pounds. 63

Watson-Flagg Thread-Rolling Machine

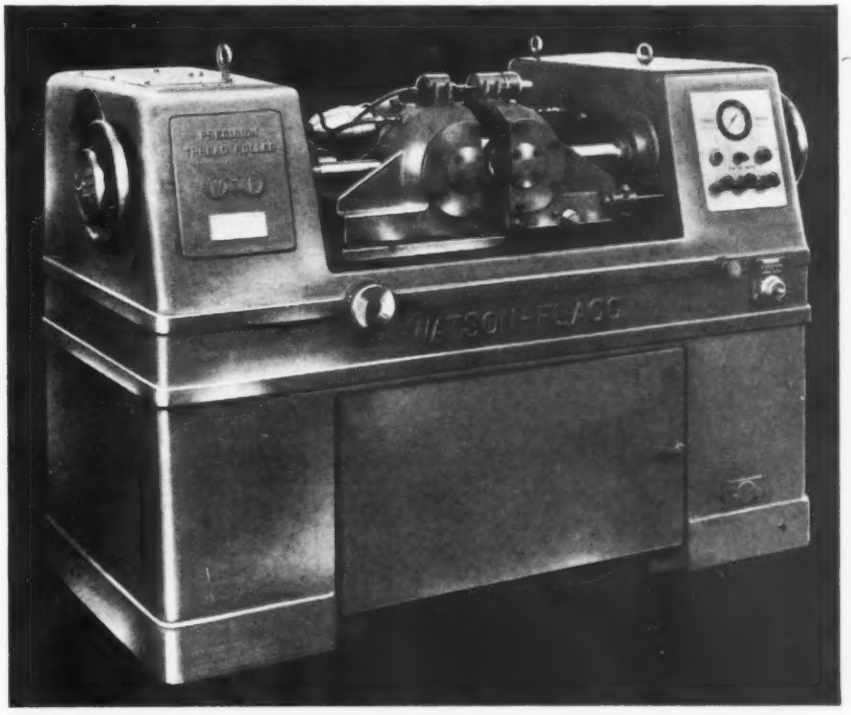
The Watson-Flagg Machine Co., Inc., Paterson, N. J., has brought out a precision thread-roller designed to automatically and consistently produce Class 4 threads, provided the blanks are held to size. The accuracy of the threads produced does not depend on the skill of the operator, but on the precision die rolls of the machine. These thread-forming or die rollers are approximately 6 inches in diameter, and have a face width of 2 1/4 inches. They are made of tool steel, hardened and ground all over. When used for forming short threads, under 1 inch in length, the rolls can be reversed, using first one side and then the other.

The builder of the machine points out that the rolling surfaces of the dies do not wear, but the rolling action finally breaks these surfaces down; thus the dies maintain their accuracy for life. Thread sizes are accurately maintained because the hydraulic rolling pressure continues until the piece reaches the finished size. The machine automatically stops the instant the large micrometer located directly over the work indicates that the thread has been rolled to the required size.

With regular equipment, the machine will roll threads from 0.138 inch to 2 1/2 inches in diameter in lengths up to 2 1/4 inches. With special arrangements, threads up to 4 inches in diameter and up to 2 3/4 inches in length can be produced. In general, threads can be rolled on any material that has an appreciable elongation, so that it will flow without breaking. This includes any steel, low- or high-carbon and alloy steels, up to 38 Rockwell C, stainless steels, brass and bronze, aluminum, magnesium, and zinc die-castings. Threads of practically any form, as well as right- and left-hand threads, can be rolled. The thread-roller can also be used in the production of taps and knurls and for grooving and serrating operations. In addition, hollow pieces with extremely thin walls can be handled on this machine.

Production rates depend on the method of handling the work and the size of the pieces to be threaded. For rolling threads on parts up to 3/8 inch in diameter, the rate averages 800 pieces per hour when the work is manually loaded and 1500 pieces when simple fixture loading is employed. It is estimated that a production of 3500 pieces per hour will be obtainable when a chute and automatic ejector now being developed are employed. For larger sizes, up to 2 inches in diameter, the production rate is about 600 pieces per hour when manual loading is used, and 800 pieces per hour with a simple loading fixture.

The machine is 72 inches wide, 34 3/4 inches deep, 51 inches high and weighs 7200 pounds.....64



Watson-Flagg Precision Thread-rolling Machine

To obtain additional information on equipment described on this page, see lower part of page 228.

"Red Ring" Diagonal Gear-Shaving Machine

A new mechanical principle involving a revolutionary method of feeding the work-gear across the cutter has been incorporated in the "Red Ring" diagonal gear-shaving machine, just brought out by the National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. With this machine, the work is fed at an angle to its axis, the angle being selected with reference to the dimensional and physical characteristics of the gear being shaved. The angle is also selected to obtain the best possible conditions for both cutting speed and surface finish.

Traversing the work diagonally under and through the cutter is said to accomplish several results that are especially desirable where a large volume of gears having the same characteristics are to be shaved. The diagonal traverse movement facilitates the shearing action at each cutting edge, thus making it practicable to remove more stock per cycle in less cutting time. The entire cutting cycle is composed of only two passes of the work through the cutter. The work-gear on the particular machine illustrated is completely shaved in fifteen seconds, 0.010 inch of stock being removed.

Another advantage of the new machine is that the full face of the cutter is effective during each cutting cycle, a feature that materially lengthens the cutter life. With the diagonal traverse movement, there is no restriction on the face width of the cutter; thus the high cost of extremely wide-faced cutters is avoided. By this process, the cutter face width can be considerably less than the face width of the work-gear, and no special cutters are required. Conventional cutters are entirely adequate, and cutter serrations need not be staggered. Other advantages claimed for the diagonal feed are better control of lead on helical gears, less danger of cutter breakage when machining shoulder gears, and less trouble with tapered-tooth conditions on such gears.

Unlike previous methods of shaving, the center distance between cutter and work-gear remains constant throughout the complete run of any size of work-gear. Loading and unloading time can be further reduced by the addition of a new quick-loading tailstock. If crowning is desired, the crown is ground into the cutting tool, and by varying the diagonal angle of feed, the amount of crown on any individual gear or group of gears can be varied any amount desired up to the equivalent of the maximum crown in the cutter itself. 65

"Red Ring" Diagonal Gear-shaving Machine

Rafter Steel Squaring Shears

A line of steel squaring shears designed to handle all types of plate and sheet-metal work at high production speeds and with exceptional cutting accuracy is now being produced by the Rafter Machine Company, Inc., Belleville, N. J. The line includes machines both larger and smaller than the one shown in the accompanying illustration, which has a capacity for taking shearing cuts up to 10 feet long in material 1/4 inch thick.

This machine is similar in design to the other sizes of the complete line. It is equipped with a ball-bearing back gage having a range of 24 inches, and dual adjusting dials having 1-inch and 1/64-inch graduations, respectively. The front gage of the machine has a range of 10 feet.

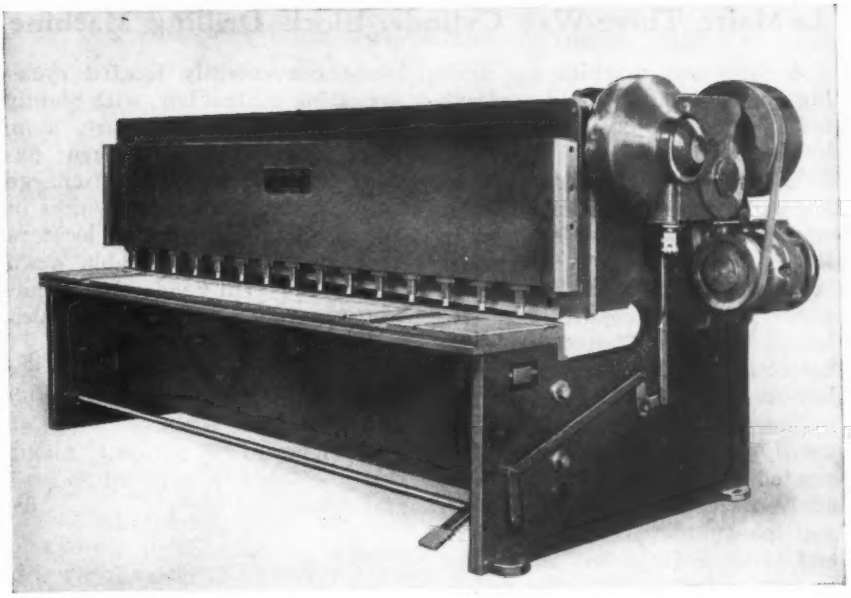
Spring counterbalances are employed to offset the weight of the back braces. These counterbalances are so designed as to apply practically a uniform tension on the back braces, regardless of the position of the knife head. They are also used to stop the knife head in the upper position when the clutch is disengaged, and thus eliminate the necessity for using a brake for continuous shearing operations.

Plunger type work hold-downs on the heavy hold-down bar at the front of the machine hold the work securely in place, compensating for varying thicknesses of metal and automatically putting

To obtain additional information on equipment described on this page, see lower part of page 228.

more pressure on the thicker sections. A simple knife-head adjustment provides for continuous shearing, slitting, and notching operations.

The shear table has a dovetail slot for its entire length and four dovetail slots machined across it to accommodate front and side gages. The machine has a standard gap of 18 inches, and is equipped with knives 1 inch by 4 inches by 10 feet 4 inches long. It operates at a speed of 60 strokes per minute when driven by a 7 1/2-H.P. 1800-R.P.M. motor. The machine weighs approximately 18,000 pounds, and requires a floor space of 12 feet 6 inches long by 5 feet 10 inches wide without the front gages.....66



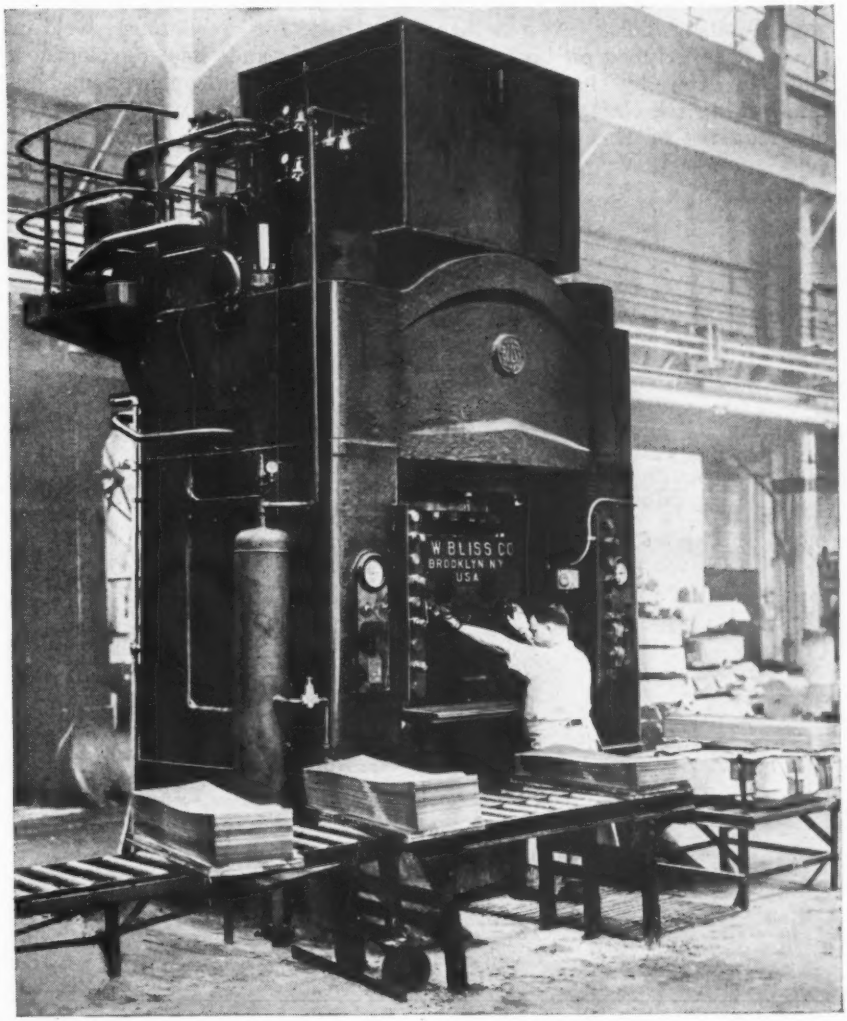
Steel Squaring Shears Brought out by the Rafter Machine Company

Bliss Single-Action Hydraulic Press

The E. W. Bliss Co., 450 Amsterdam St., Detroit 2, Mich., has recently added to its line of single-action hydraulic presses a new model of 1500 tons capacity. This housing type press can be used to produce blanked, stamped, formed, pierced, trimmed, drawn, and embossed parts from sheet metal. One of these presses, equipped as shown in the accompanying illustration for drawing and piercing 0.025-inch thick stainless-steel evaporator plates for home refrigerators, has just been installed at the Erie, Pa., plant of the General Electric Co.

The rugged frame of the press has fully shrunk tie-rods and keyed housings. Other features include positive drive for the closing stroke; universal electric control, with provision for speed changing and reversing; safety control for instant stopping at any point; convenient pressure adjustment; and delayed action of the cushion return, which allows the slide to rise from the work before the finished piece is stripped from the die. Reversal is effected automatically by either predetermined pressure or position of the slide.

The press has a ram stroke of 12 inches and a hydraulic drawing cushion stroke of 6 inches. The quick-advance speed of the ram is at the rate of 750 inches per minute, and the pressing speed is 17 inches per minute. Return speeds are 675 inches per minute without the cushion and 340 inches per minute with the cushion. The cushion return speed is 285 inches per minute. The height of the installed press above floor level is 183 inches. 67



Bliss Press Installed in Erie Plant of General Electric Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

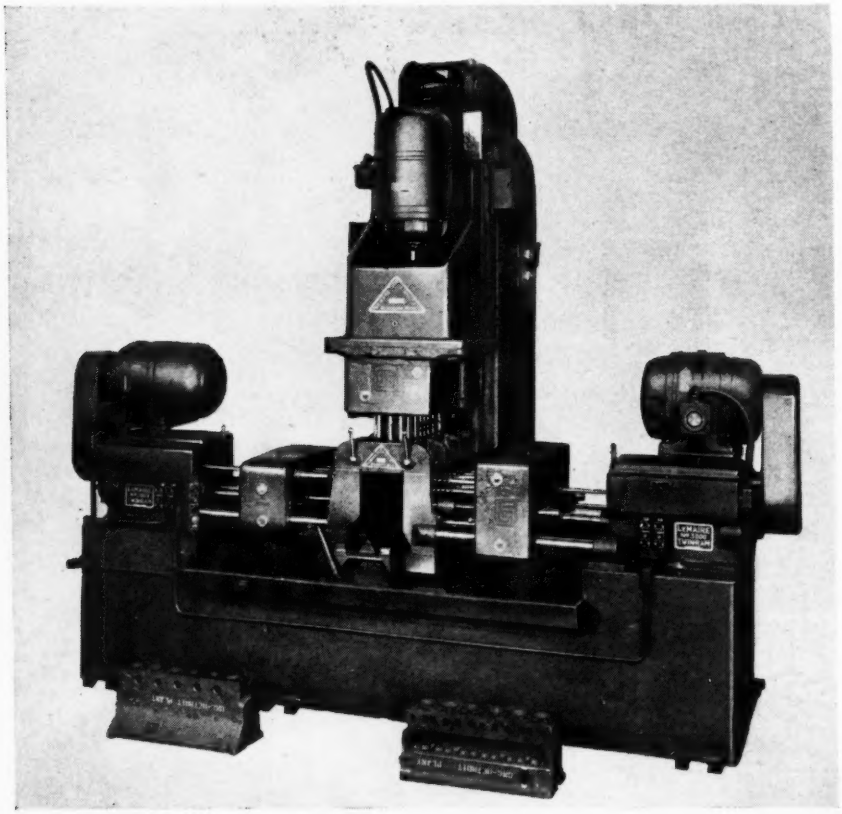
Le Maire Three-Way Cylinder-Block Drilling Machine

A three-way machine for drilling the top and both sides of cylinder blocks has been brought out by the Le Maire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. This machine is equipped to drill nineteen holes in the right-hand side of the cylinder block and thirty-four holes in the top; drill and counterbore five holes; drill and spot-face two holes; and drill three holes in the left-hand side.

The new machine consists primarily of a one-piece rigidly fabricated base, on which are mounted Le Maire twin ram units with multiple-spindle heads, at each end, and a Le Maire slide type hydraulic drilling machine (without table and base) at the rear. The fixture is of the tunnel type, incorporating all drill bushings.

The work is slid into the fixture on "wear" strips, and guided by the crank bore to an approximate work-locating stop. Manually operated retractable pins then engage locating holes, after which the part is gripped on both sides and the top by hand-operated cam-locking toe clamps. Outstanding features of this machine include conveniently located cycle-operating control box, with plainly marked buttons for start, stop, start, and emergency return; fixture designed to easily discharge chips; extra large chip troughs in the machine base; fixture locators that are easily replaceable when worn; and drill heads and standard hydraulic drill units equipped with helical gears.

The production capacity of this machine is approximately 60 pieces per hour when operating at an efficiency of 100 per cent. About thirty seconds is required to load and unload the work. 68



Le Maire Special Machine Built for Drilling Cylinder Blocks

G-E Synchronous and Non-Synchronous Controls for Resistance Welders

The Control Division of the General Electric Co., Schenectady 5, N. Y., has redesigned its complete line of synchronous precision controls for resistance welding machines, and has developed a new line of non-synchronous electronic resistance welding control combinations. All components of these control systems have been designed to meet the new NEMA standards.

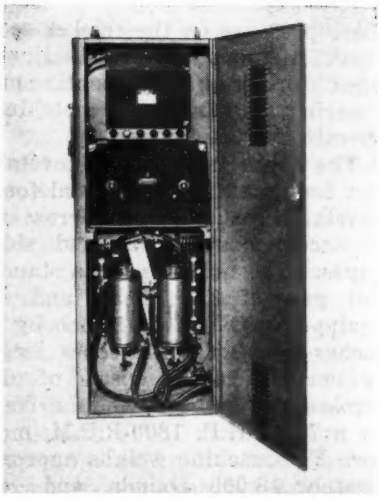


Fig. 1. General Electric Synchronous Precision Control for Resistance Welding Machines

The synchronous control system, including the ignitron contactors, weld timer, electronic heat control, and optional equipment such as sequence and tempering controls, are housed in one cabinet, as shown in Fig. 1, which can be easily mounted on the machine. All components except the ignitron contactors are mounted on hinged panels, which can be swung out for inspection without interrupting the service. These controls are designed for spot and projection welding on air-, motor-, and foot-operated resistance welding machines.

The weld time or heat time is adjustable from 1 to 30 cycles in one-cycle steps by an adjuster calibrated in cycles having the same frequency as the power supply. Stepless electronic heat control permits accurate adjustment to meet precise welding procedure. Special provision is made for temper welding air-hardenable materials to obtain strong dutile welds and eliminate brittleness.

The new line of non-synchronous electronic resistance welding controls includes combinations of ignitron contactors and sequence-weld timers, with or without electronic heat control, all mounted in a single cabinet as shown in Fig. 2. Although designed for mounting on the welding machine, the control cabinet can be placed on the floor beside the machine or mounted on a wall or balcony.

The ignitron contactors offer

To obtain additional information on equipment described on this page, see lower part of page 228.

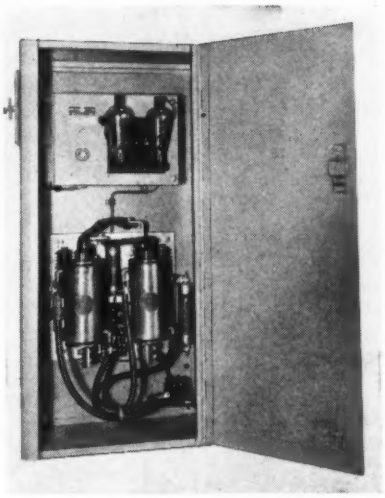


Fig. 2. General Electric Non-synchronous Control for Resistance Welding Machines

high-speed operation and flexibility, and the sequence-weld timers employ voltage-regulation tubes in the timing circuit to insure accurate timing, regardless of normal time voltage variations. The use of industrial type relays, cabled wiring, and plug-in timing panel and accessories simplifies servicing and increases flexibility. Electronic heat control provides smooth, stepless adjustment of the welding current. 69

Allis-Chalmers "Pedrifugal" Pumps

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has developed a new line of "Pedrifugal" pumps at its Norwood Works to meet the needs of a wide range of users who require a sturdy pump of moderate capacity. This line of cast-iron, bronze-fitted, pedestal type centrifugal pumps includes three sizes, covering a capacity range of from 10 to 500 gallons per minute at heads of 10 to 100 feet, with power requirements of from 1/4 to 15 H.P.

These pumps are designed expressly for Texrope V-belt drives, providing an infinite range of capacities regulated by the size of the sheaves and power supplied. All pumps are fitted with impellers of maximum diameter, and variations in capacity are provided by changes in speed. They are adapted for use on machine tools and such equipment as commercial washers, large Diesel engines, and air conditioners. 70

Rogers Face and Knife Grinder with Finger-Tip Control

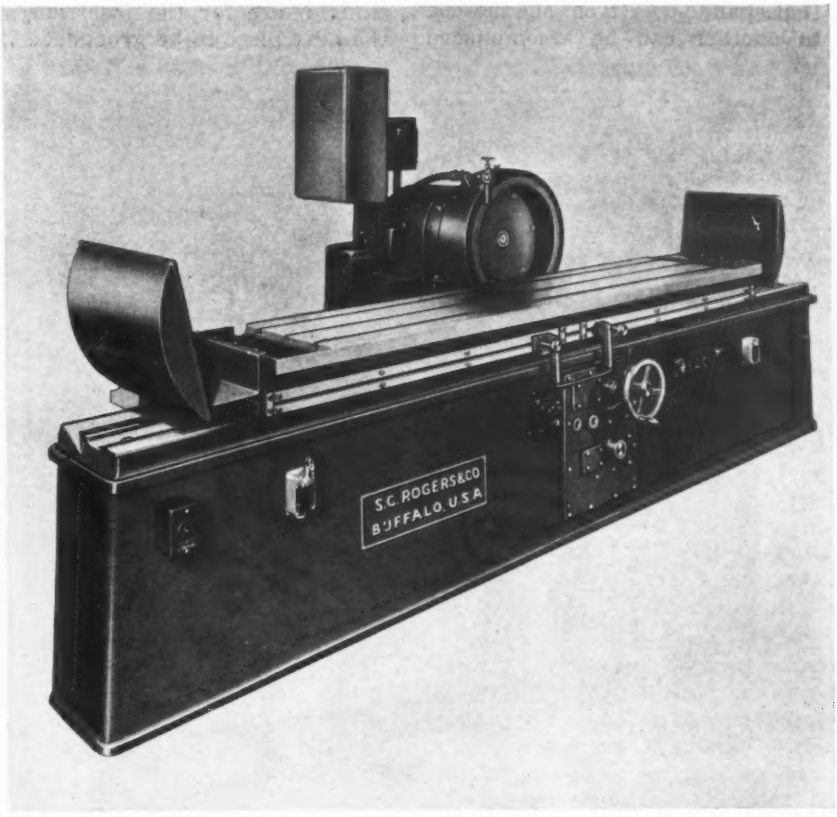
An electronically driven face and knife grinder with a single finger-tip control dial that permits speed changes within the range of 5 to 70 feet per minute to be obtained while the machine is running has been announced by Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo 11, N. Y. This control is achieved through an electronic panel, complete with rectifiers and their supporting tubes and circuits.

The grinder is so designed that it can be easily controlled by even an inexperienced operator, the electronic drive allowing exactly the right speed to be selected for each kind of work—slow traverse for heavy cuts or fast traverse for light cuts with high finish. Quality of the work is said to be greatly improved because the electronic drive not only provides correct cutting speed, but holds it as well. The control produces no noise or vibration and no shock at reversals.

The table traverse is actuated merely by pushing the starting button, which controls a direct-current motor. The speed-adjusting finger-tip dial can be preset for any speed within the specified range. The motor comes to the preset speed smoothly because of the constant current-limit acceleration provided. Results can often be improved by starting the tool into the load at low speed and at full torque. Reversing, quick stopping, and complete control are automatically provided for in both forward and reverse operations. Smooth contact limit switches with reversing levers are provided, which are adjustable to the length of traverse desired.

An ordinary alternating-current source of power is all that is necessary to drive the 10-H.P. motor. Connection to direct current is automatically made through the electronic panel. The table is 72 inches long and 16 inches wide. Grinding operations are performed by a 20-inch, cylinder type grinding wheel.

This traveling-table face grinder has been designed especially for high, steady production on iron and steel parts. It is adjustable for grinding long or narrow recessed areas or wide solid sections



Rogers Face and Knife Grinder Equipped with Electronic Drive

To obtain additional information on equipment described on this page, see lower part of page 228.

up to 12 inches in width. When fitted with a revolving knife-holder, it is suitable for production or maintenance grinding of flat parts, knives, or shear blades to a high degree of accuracy.....71

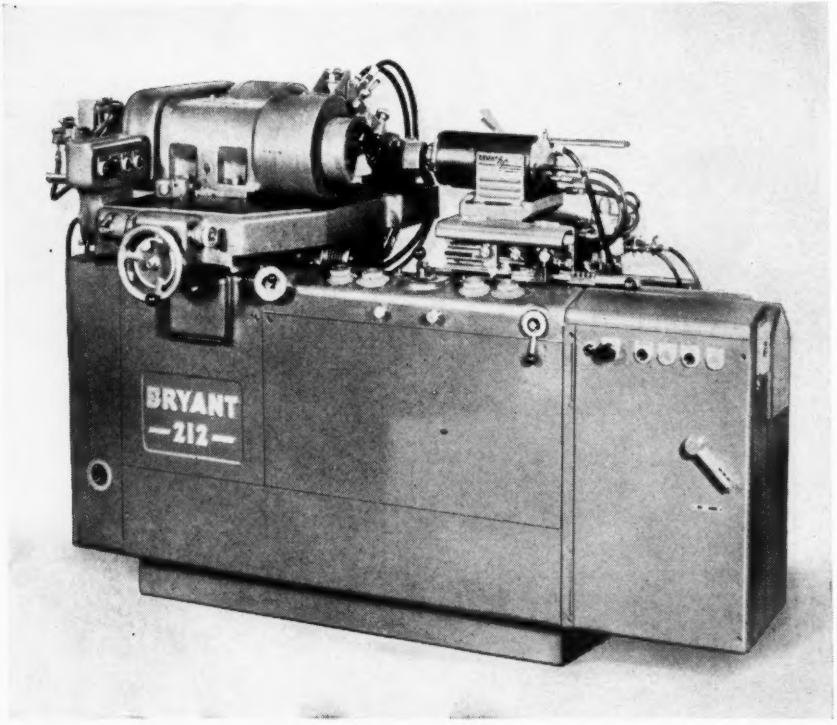
Bryant Automatic Internal Grinder

A precision automatic internal grinder, designed for high production with a minimum of attention from the operator, has been brought out by the Bryant Chucking Grinder Co., Springfield, Vt. The machine has a swing of 9 inches inside the standard water guard, and a total wheel-slide traverse of 12 inches. The cross-feed is obtained by lateral motion of the work-head, which is supported by specially designed anti-friction bearings of the roller type.

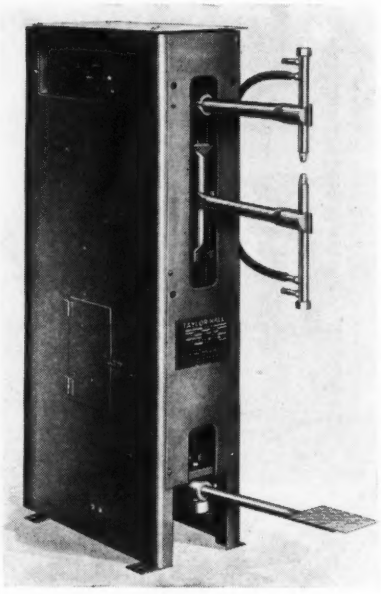
Bores ranging from 5/16 inch up to 3 1/2 inches in diameter and up to 3 inches in length can be ground. For the smaller range of bores, Bryant "Hi-Frequency" wheel-spindles operating at speeds up to 100,000 R.P.M., can be used. A variety of standard and special tool equipment can be employed when necessary to suit special requirements.

Three methods of automatic sizing can be provided for this machine, which is so designed that change-over from one method to another can be accomplished merely by the addition of the sizing equipment. Sizing with the truing diamond is accomplished by predetermined advance of the wheel beyond the wheel-truing position, which is performed between rough- and finish-grinding positions of the cycle, wheel wear being automatically compensated for by the machine. Automatic plug sizing is accomplished by a plug gage, mounted in the work-spindle, which automatically checks the bore size after each pass of the grinding wheel. As the plug gage enters the bore, the machine automatically stops grinding, and the wheel withdraws from the bore to permit reloading when the bore is ground to size.

The third method of sizing employs a diamond-tipped finger which contacts the bore as it is being ground. At the proper instant, the finger operates electrical contacts, which arrest the grinding action of the machine and cause the wheel to be withdrawn from the bore, making the machine ready for the insertion of the next piece to be ground.....72



Bryant Precision Automatic Internal Grinder Designed for High Production



Taylor-Hall "True Pressure" Spot-welder

"True Pressure" Spot-Welder

The Taylor-Hall Welding Corporation, Subsidiary of the Federal Machine & Welder Co., Warren, Ohio, has announced a new line of press type spot-welders which employ the "True Pressure" principle, by means of which the welding pressure is applied by a straight vertical movement of the upper electrode. The vertical ram on which the upper horn is mounted rides on V-shaped slides having a length of 20 inches. The lower horn has a vertical adjustment of 6 inches and a swing adjustment of 90 degrees. The welders require a floor space of 9 by 20 inches, and are available in 5- and 10-KVA capacities.....73

Johnson Metal Melting Furnace

The Johnson Gas Appliance Co., 581 E Ave., N.W., Cedar Rapids, Iowa, has brought out a gas-fired furnace designed for the rapid and economical melting of such metals as lead, babbitt, tin, zinc, aluminum, and type metal. The six atmospheric-fired direct-jet bunsen burners, each with independent shut-off valve and pilot light, will quickly heat the melting pot to 1500 degrees F., after which the working temperature can be maintained by three burners. Heavy refractory insulation

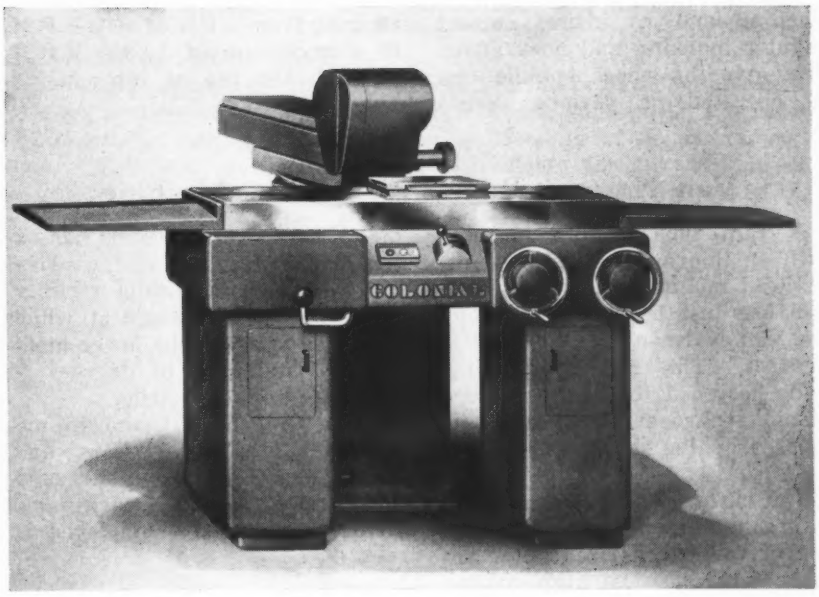
To obtain additional information on equipment described on this page, see lower part of page 228.

around the removable melting pot serves to retain heat. The furnace has a capacity for melting 600 pounds of lead in twenty-nine minutes. 74

High-Speed Welder

A new development in automatic multi-spot resistance welding machines has been announced by the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich. The first production machine of this type, known as "Progress-O-Matic," was exhibited at the recent Metal Show in Atlantic City.

In addition to its high speed of operation, an outstanding advantage of the machine is that the various welding guns can be employed to weld metal of different thicknesses where variable welding times, heats, and speeds are required. The manner in which this is accomplished is as follows: Actuation of the individual spot-welding guns is controlled by an air-driven "Progress - O - Matic" unit. This unit serves to control the operating sequences of the entire machine, including application of welding pressure to timing of welds and control of welding current heat supplied for each individual gun. The air pressure required to operate the machine at high speeds is provided by a compressor of the superimposed piston type driven by a 5-H.P. alternating-current motor. 75



Broach-sharpening Machine Made by the Colonial Broach Co.

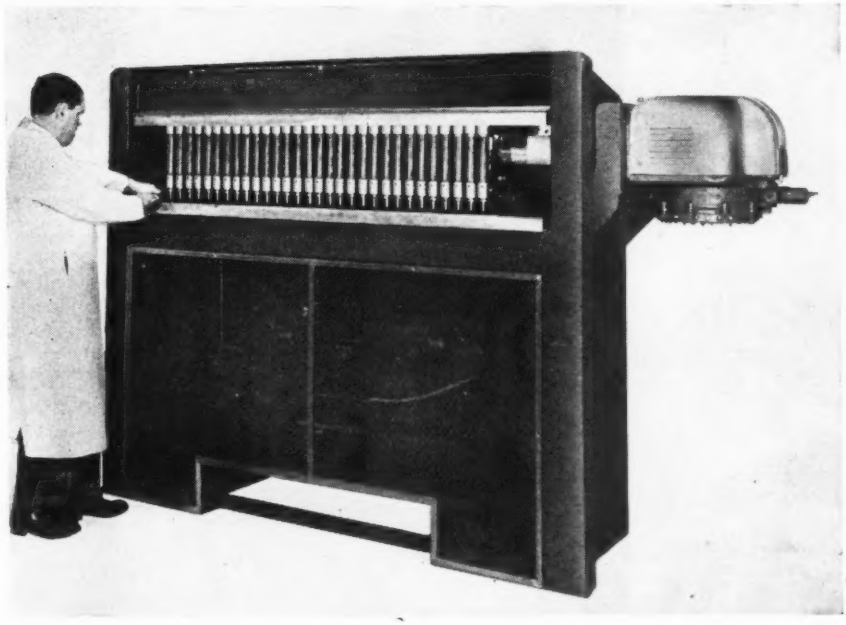
Colonial Broach-Sharpening Machine

A new broach-sharpening machine, designed to permit tool grinders to sharpen flat surface broaches up to several feet in length while comfortably seated in a relaxed position, has been brought out by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. The base of this machine is built up of three pedestals, arranged as shown in the illustration. Two of the pedestals support the table at each side, forming a deep space for the operator's knees. The third pedestal, located at the back, supports the grinder head.

Two handwheels for controlling lengthwise movement of the table and for raising and lowering the grinding head are located at the right-hand side of the machine. While the operator can easily reach these handwheels, they are out of the way when it is necessary for him to lean over the machine for adjustment or inspection. The main operating control of the machine, known as the "Lazy-Reach" lever, with which the grinding wheel is moved back and forth across the face of the broach teeth, is mounted on the front of the machine. The cross-slide, which carries the grinder head, is of light weight construction, and is mounted on ball bearings to eliminate sliding friction. Adjustable cushioned stops guard against shock at the end of the cross-slide traversing movement.

Start and stop buttons and a magnetic - chuck switch lever, available as extra equipment, can be located at the front of the machine in such a manner as to be instantly accessible, but not interfere with the operator.

The table is 48 inches long and has a travel of 36 inches. Broaches that are longer than the table can be readily handled by extending one end beyond the table while the other end is being sharpened. Graduated dials are provided to facilitate quick setting up of the



High-speed Automatic Welder Developed by Progressive Welder Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

machine and to insure correct angular indexing and hook angle. The grinding-wheel spindle can be operated at various speeds ranging from a low of 4000 R.P.M. to a maximum of 10,000 R.P.M. through the use of interchangeable pulleys. 76

Van Norman Ram Type Milling Machine

A ram type milling machine with an improved adjustable cutter-head mounted on the movable ram has just been announced by the Van Norman Co., Springfield 7, Mass. This machine is especially designed for use in pattern shops, tool-rooms, tool and die shops, machine shops, and laboratories.

The cutter-head is designed to assure maximum rigidity when set for vertical, horizontal, or angular milling. The high column makes it possible to accommodate exceptionally large work between the cutter-head and the table when the table is in its lowest position. A design feature that permits the table to be brought nearly up to the center line of the spindle also serves to increase the versatility of the machine.

Front and rear directional controls of all power feeds, with provision for locking any feed in neutral, facilitate operation and permit a clear unobstructed view of the cutting operation from either position.

The machine is available with either a universal or a plain saddle. The universal saddle has extensions on each end of the swivel units to give maximum rigidity, regardless of the angle at which the table is set. The lower member is graduated in degrees to facilitate angular setting.

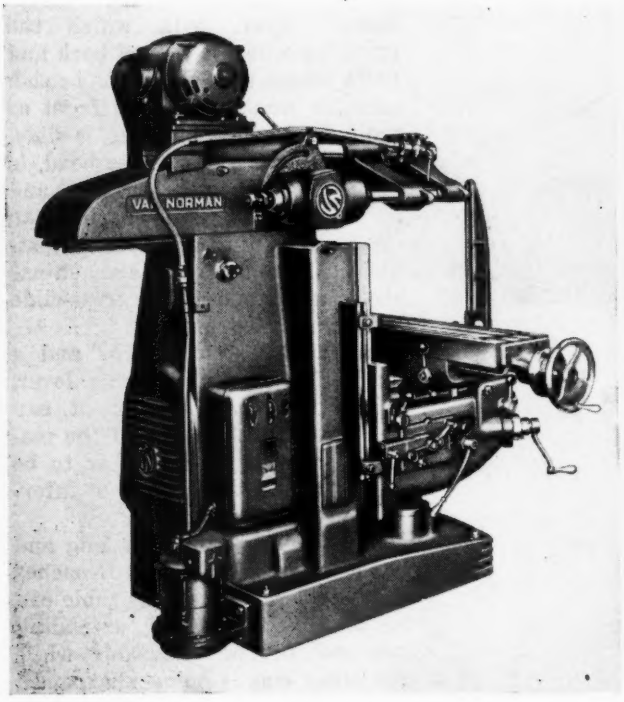
Multi-splined shafts and chrome-molybdenum alloy steel gears which are shaved, induction-hardened, and lapped, together with taper roller bearings, are employed in the spindle transmission unit to assure smooth and quiet operation. The spindle can be furnished with either a No. 13 B & S or a No. 40 National standard taper.

The table is 50 by 10 inches, and has a longitudinal range of 28 inches, a cross traverse of 10 inches, and a vertical movement of 20 inches. There are nine spindle speeds ranging from 40 to 1100 R.P.M., and twelve feeds from 0.5 inch to 36 inches per minute. The spindle is driven by a 3-H.P. motor, and the feed by a 1 1/2-H.P. motor. When equipped with the universal saddle, the machine weighs 3750 pounds and requires a floor space of 98 by 72 inches. 77

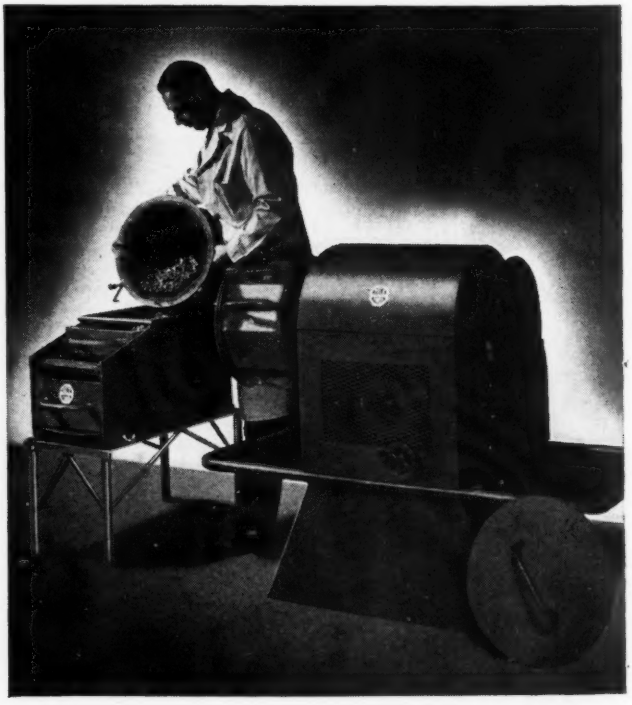
Midget Size "Roto-Finish" Machines

A midget size machine designed to handle very small parts has been added to the "Roto-Finish" line of finishing and deburring machines placed on the market by the Sturgis Products Co., Sturgis, Mich. This machine has a work-tumbling cylinder 8 inches wide by 12 inches across the flats, and is operated by a variable-speed drive having a range of 35 to 70 R.P.M. The flats are lined with kiln-dried hard maple, and the ends are rubber sealed. The cover is secured to the cylinder and the cylinder mounted on the machine by a locking and clamping device which permits quick loading and unloading.

All mechanical finishing operations, such as grinding, deburring, polishing, "Britehoning," and coloring, can be performed on this machine. The controlled rotary action of the wet mixture of "Midget" chips and compound used in this "Roto-Finish" machine is designed to produce surfaces that are suitable for plating by removing the burrs, sharp edges, and corners from stampings, machined parts, and die-castings. 78



Adjustable-head Ram Type Milling Machine



Midget Size "Roto-Finish" Machine

To obtain additional information on equipment described on this page, see lower part of page 228.

Edlund High-Production "Drill-O-Matic"

A high-production, automatic drilling machine of unusual versatility, known as the "Drill-O-Matic," has just been announced by the Edlund Machinery Co., Inc., Cortland, N. Y. This new machine has been designed to combine all the desirable features of single-purpose machines with adjustments that permit it to be readily adapted for multiple operations on pieces of widely varying size and shape.

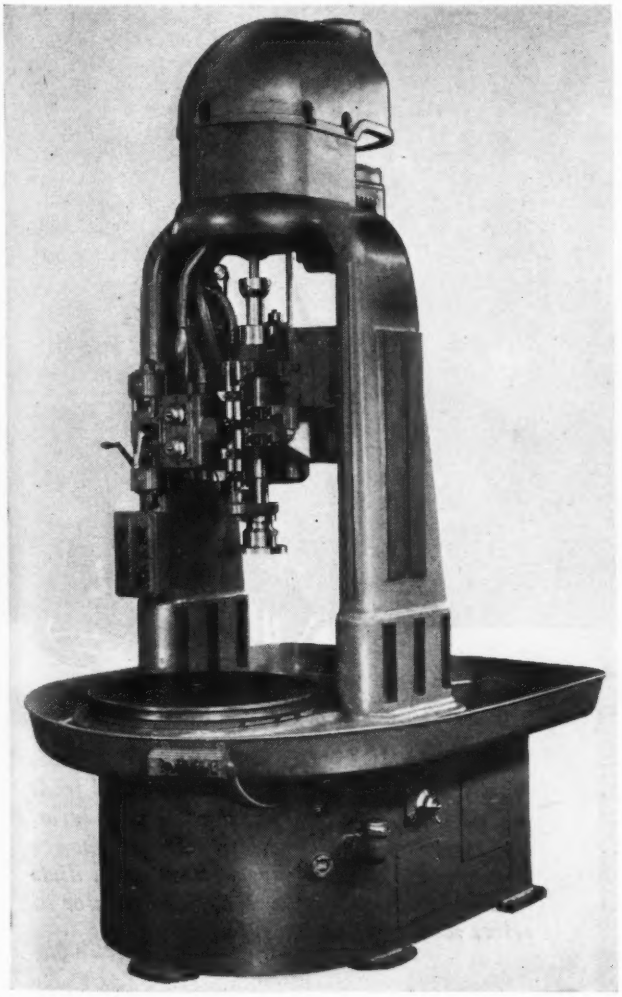
This machine will automatically perform intricate and precision drilling, countersinking, counterboring, spot-facing, reaming, and tapping operations on a wide range of work-pieces with a minimum of tooling costs. Flexibility of application is obtained by the almost infinite number of combinations of spindle movements and table and indexing operations, obtained through simple adjustments and table substitutions. Features of the spindle operation include rapid approach, variable feed over a wide range, optional dwell of selected timing, and rapid return. The feed and speed of the spindle can be changed by simple visible controls that take but a moment to operate. The spindle is driven by a constant-speed, foot-mounted, ball-bearing motor through a variable-speed V-belt. The spindle sleeve is fitted with a flanged quill for carrying a multiple drill head, which can contain any number of spindles that the piece requires, within the capacity of the machine.

The spindle has a travel of 6 inches, and the spindle bracket an adjustment of 7 inches. The maximum distance from spindle nose to table with 12-inch riser blocks is 22 3/4 inches. The spindle nose has a Morse No. 3 taper. The table has a diameter of 28 inches, and has provision for any number of indexing movements from 4 to 12, inclusive.

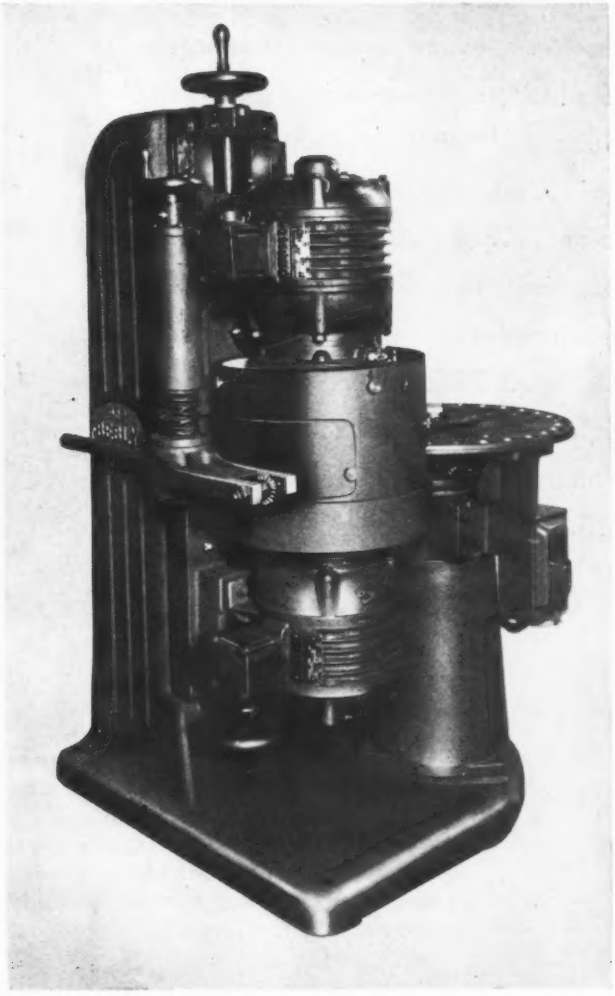
The regular spindle speeds, using a 900-R.P.M. motor, range from 360 to 2000 R.P.M. with direct drive, and from 90 to 500 R.P.M. with the back-gears. Using a 1200-R.P.M. motor, the speed range is from 480 to 2680 R.P.M. with direct drive, and 120 to 670 R.P.M. with the back-gears. The machine requires a floor space of about 58 by 70 inches, and weighs 6100 pounds. 79

Besly Vertical Grinder with Double Opposed Spindles

A vertical grinding machine with double opposed spindles and a horizontal rotary feed adapted for high-production grinding of the opposite ends of steel rollers, carbon brushes, washers, and sim-



Edlund "Drill-O-Matic" High-production Automatic Drilling Machine

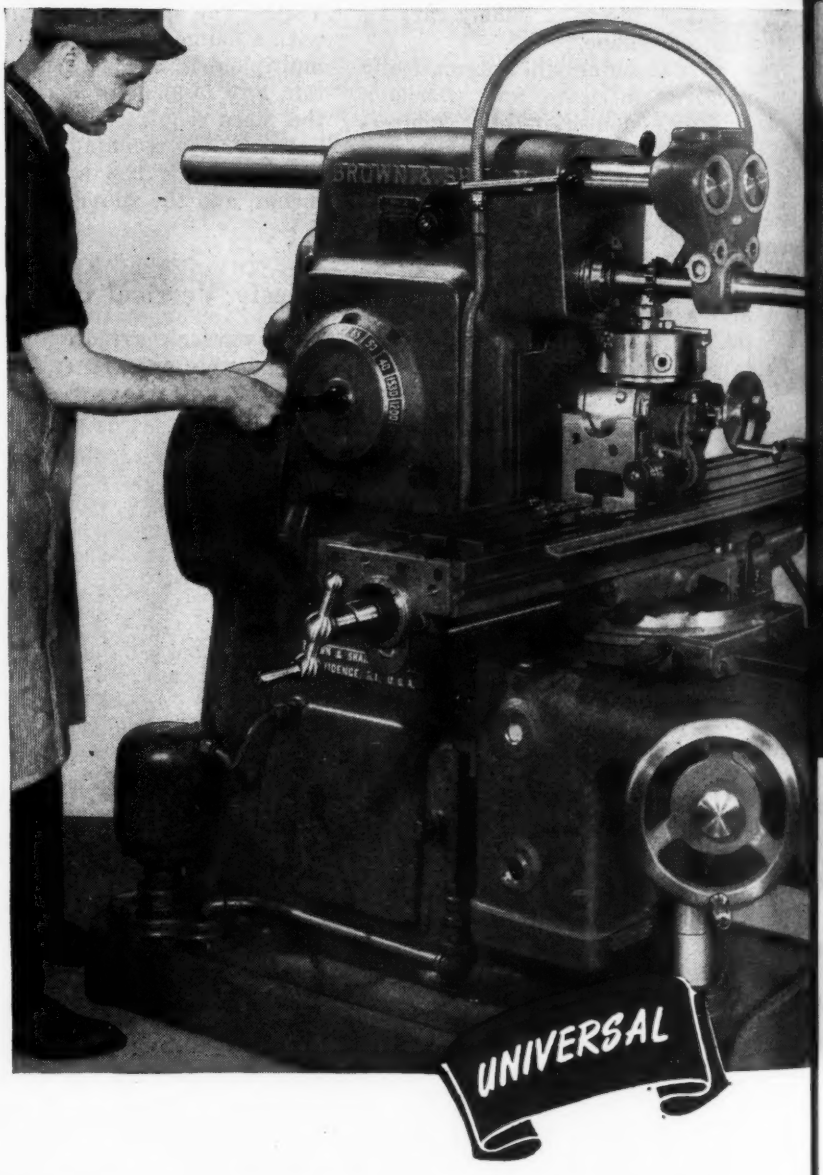


Vertical Grinder with Double Opposed Spindles Built by Charles H. Besly & Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

In these Light Type Milling Machines — *All the features for efficient production in toolroom and shop*

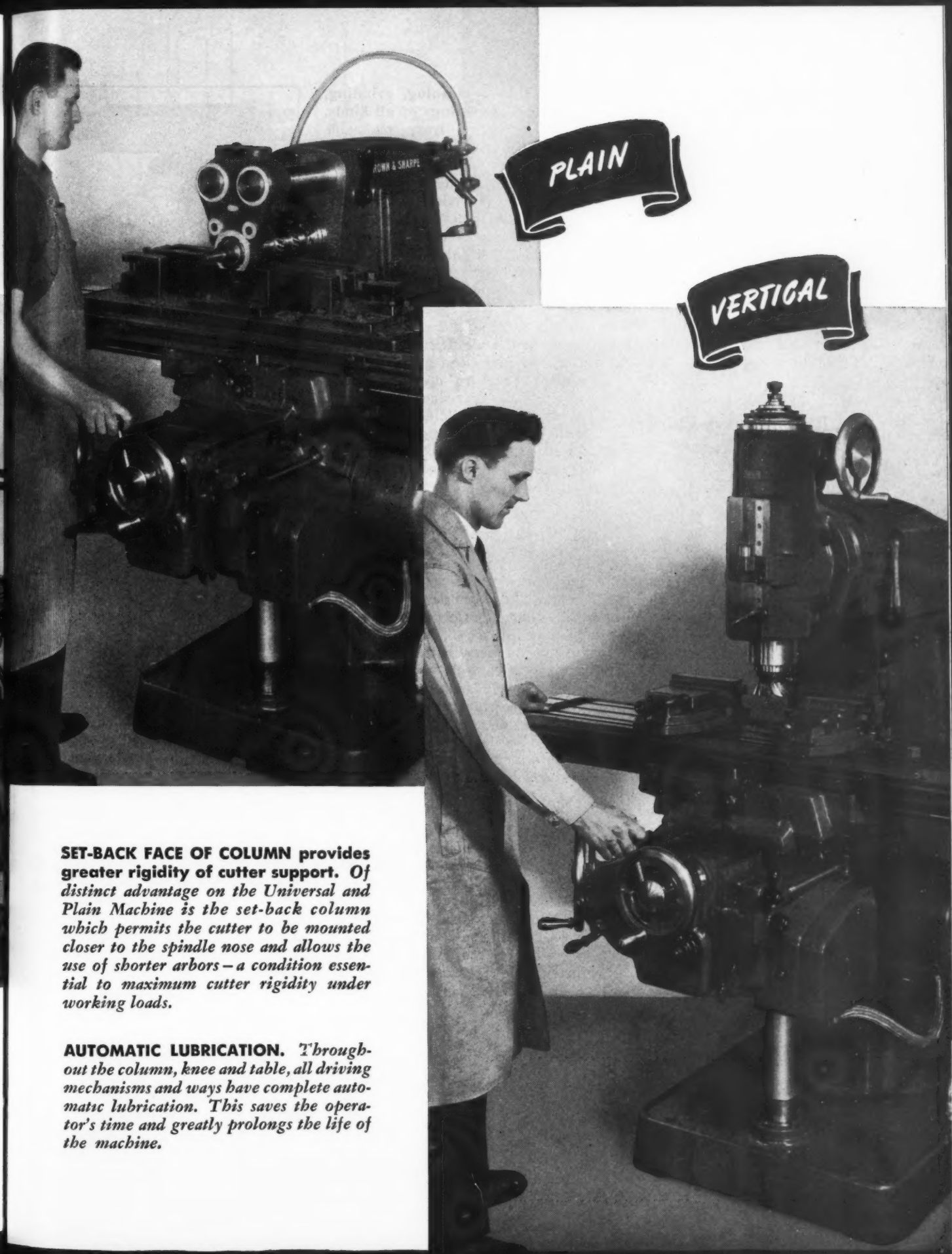
BROWN & SHARPE designed these moderate weight, sensitive machines for rapid, easy set-up and handling. Yet they are proportioned to insure more than adequate rigidity and to hold their original accuracy through a long, economical life. They have the "feel" that satisfies every instinct of a good machinist. Such features give the purchaser, over the years, the largest possible return on a sound investment. These and other production advantages . . . needed more today than ever before . . . are fully illustrated and completely described in separate specifications for each of the No. 2 Universal, No. 2 Plain, and No. 2 Vertical Light Type Milling Machines. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



CONTROLS, naturally positioned . . . fatigue preventing . . . time saving. *Where the operator would naturally expect to find each control, that's exactly where it is on these machines. Controls are grouped for convenient reach and normal hand and arm movements at the front.*

AMPLE RANGES OF SPEEDS AND FEEDS, quickly, easily selected. *Speeds and feeds are each selected by rotating a single lever, one turn in either direction, giving a change in rate. Large, easily read figures on dials indicate rates available. Easy for operator to select most productive rate.*

BROWN &



SET-BACK FACE OF COLUMN provides greater rigidity of cutter support. *Of distinct advantage on the Universal and Plain Machine is the set-back column which permits the cutter to be mounted closer to the spindle nose and allows the use of shorter arbors – a condition essential to maximum cutter rigidity under working loads.*

AUTOMATIC LUBRICATION. *Throughout the column, knee and table, all driving mechanisms and ways have complete automatic lubrication. This saves the operator's time and greatly prolongs the life of the machine.*

SHARPE

B·S

J. E.

ilar parts has been brought out by Charles H. Besly & Co., 118-124 N. Clinton St., Chicago 6, Ill. Each spindle is direct-driven by a 1-H.P. 1800 R.P.M. motor, and is equipped with a bolted-on abrasive disk 12 inches in diameter.

Parts to be ground are simply dropped into holes in the feed wheel, which carries them between the abrasive disks for simultaneously grinding both ends. The machine, as shown in the illustration equipped for grinding small coil springs, has a production rate of 3000 to 4000 pieces an hour...80

Rotor Heavy-Duty Air Grinders

Two new "Power Plus" heavy-duty air-operated grinders, in straight- and spade-handle types, have been added to the line of the Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio. These grinders have the light weight, fine balance, and easy maintenance advantages of the preceding models, and in addition have greater power and higher load speeds without increase in weight.

The smaller grinder weighs only 9 3/4 pounds, and is available in speeds of 6000 R.P.M. for 6-inch elastic wheels and 4100 R.P.M. for 6-inch vitreous wheels. It can also be used at a speed of 6000 R.P.M. for 4-inch vitreous wheels.

The larger grinder, which weighs 11 1/4 pounds, can be used with 8- by 1-inch elastic wheels at a speed of 4500 R.P.M., and with 6- by 1-inch vitreous wheels at a speed of 4100 R.P.M. It can also be employed with 8- by 1-inch vitreous wheels at a speed of 3100 R.P.M.

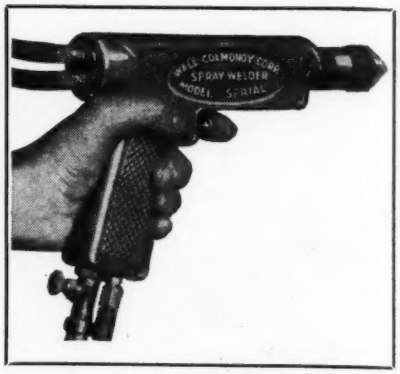
These grinders are adapted for such work as cleaning, grinding, or snagging castings of all kinds, including gray iron, malleable iron, steel or non-ferrous metals; hogging out defects in large steel castings for welds and grinding the welds; removing fins; grinding welds in structural steel work; and polishing sheet-metal work, particularly stainless steel.

The new rotary governor used on these grinders causes them to idle at the free speed determined by the Safety Code, and to quickly increase the air delivery to maintain the high load speed as soon as the pressure applied to the work tends to reduce the speed. Mufflers are available where conditions require quiet operation. Two extensions can be supplied for reaching inaccessible spots...81

Colmonoy "Spraywelder"

A new type of powder metallizing unit, known as the "Spraywelder," has been developed by the Wall Colmonoy Corporation, 19345 John R, Detroit 3, Mich., for use in conjunction with this company's "Sprayweld" process. The "Spraywelder" is designed to combine the advantages of both welding and metallizing. It is first operated as a powder metallizing unit to apply a uniform overlay of the Colmonoy alloy, after which it is used as a conventional torch to fuse the sprayed overlay to the base metal. This produces a fusion or molecular bond identical to that obtained when the same alloy, in rod form, is applied by acetylene welding.

The new unit has only two control valves, both of which are mounted on the gun. Once adjusted, the powder flow can be

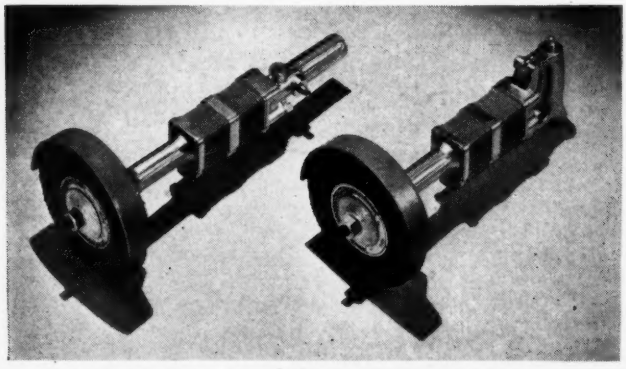


"Spraywelder" Developed by the Wall Colmonoy Corporation

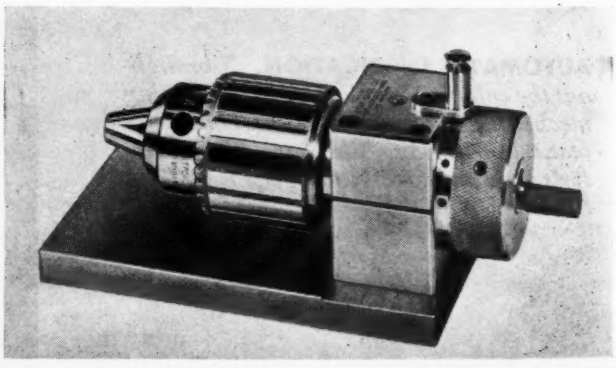
stopped and started at will by pressing or releasing the trigger. The gun is light in weight, and can be operated by hand or held in a vise. It can also be mounted on the toolpost of a lathe by means of an attachment. Although the "Spraywelder" was primarily designed for spraying Colmonoy alloys, it will handle other powdered alloys equally well. 82

Rotary Grinding Attachment for Surface Grinder

Bancroft and Forssen, 64 Monmouth St., Springfield 9, Mass., has recently acquired the exclusive distribution rights for a new rotary grinding attachment known as the "Sta-Ga-Co," which is being manufactured by the Star Gauge Co., Springfield, Mass. This attachment can be applied to the magnetic chuck of a surface grinder for grinding cylindrical, flat, or other surfaces to a high degree of accuracy from hardened stock. It can be used for making bushings, punches, step studs, and

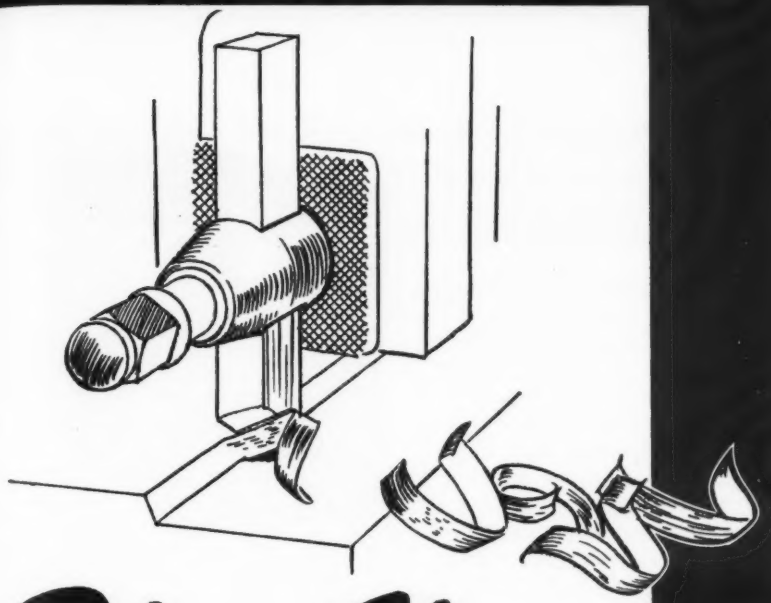


Rotor "Power Plus" Heavy-duty Grinders with Straight and Spade Type Handles



Rotary Grinding Attachment for Surface Grinder, Placed on Market by Bancroft and Forssen

To obtain additional information on equipment described on this page, see lower part of page 228.



Blue Chips

Cincinnati Shapers cut blue chips that are profitable chips. Blue chips come from tough die steels that present unusually tough machining problems.

The machine must be accurate in performance, must deliver unusual power at the cutting tool, and must have great stamina. On these things hinges the profitable handling of these tough steels.

Cincinnati Shapers, with their outstanding performance, are found in large numbers in tool and die plants everywhere.

Our representative in your neighborhood will gladly consult with you on increasing accuracy and profit in your shop.

Our Engineering Department is at your service. Ask their advice on your shaping problems.

Write for Catalog N-3

• THREE TIMES AS TOUGH . . .
By test, die steels are often three times as tough as mild steel—and machining demands are correspondingly more severe.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

plug gages, and for grinding radii, flats, round and longitudinal slots, as well as for performing grinding operations on a wide range of miscellaneous pieces.

With this attachment, work can be ground to an accuracy of 0.0005 inch. The dividing head will make up to twelve divisions with an accuracy limit of 4 minutes. The spindle has a 7/16-inch hole, and is fitted in accurate lapped bearings, which are adjustable for wear. The attachment weighs about 10 pounds, and is equipped with a 1/2-inch Jacobs chuck.....83

"Twin Disc" Hydraulic Couplings for Small Motors

A new series of small hydraulic couplings for use with induction motors and small internal combustion engines has been announced by the Hydraulic Division of the Twin Disc Clutch Co., Rockford, Ill. The six couplings in the new series have various ratings, ranging from 1 to 25 H.P., at 1800 R.P.M., and are designed to supplement the line of "Twin Disc" hydraulic couplings built for larger applications. They are designed to assure smooth acceleration, prevent stalling, allow the engine or motor to be fitted to actual running requirements, eliminate the need for shear pins and similar "break and replace" protection devices for driven parts, distribute the load on multiple engine or motor drives, permit the reversing of electric motors at full-load speed without high current surges, and, in the case of a standard motor, permit the motor to start under no load and thus make high torque available for starting.

Both the impeller, or driving member, and the runner, or driven member, are light-weight aluminum castings. A cast-iron insert forms the hub of the driven member, taking the drive to the output shaft. Stamped steel core rings in both the impeller and the runner form the hydraulic circuit. The units are assembled by installing the runners and then merely screwing together the impellers with a rubber or Coprene ring gasket to prevent leakage of the hydraulic fluid. 84

"Hydrauliscope" for Analyzing Hydraulic Pressure Phenomena

A high-speed electronic analyzer of compact, portable design which gives consistent results in the analysis of hydraulic pressure phenomena, even when used by persons unfamiliar with electronic devices, has been brought out by the Aeroquip Corporation, Jackson, Mich. The control and adjustment facilities of this analyzer, known as the "Hydrauliscope," are simple but sufficient to accomplish the indication and recording of high-speed pressure phenomena incident to the operation of hydraulic systems.

The "Aeroquip" pressure pick-up element used in connection

"Aeroquip Hydrauliscope"

with the "Hydrauliscope" is of the resistance type. Among the outstanding features of this pick-up are response to pressure changes of high frequency and high rate, and high sensitivity. The "Hydrauliscope" translates the output of the pressure pick-up to vertical deflections on a cathode-ray oscilloscope. Only two external connections are required—one to the pressure pick-up and one to any standard 105- to 125-volt 50- to 1800-cycle power service—to put the analyzer in operation.

Attachments can be furnished to permit photographic records to be made of the curves traced on the screen of the cathode-ray tube. Interchangeable guide plates can be inserted in front of the screen to provide direct calibration at standard scale factors, such as 2000 or 500 pounds per square inch. 85

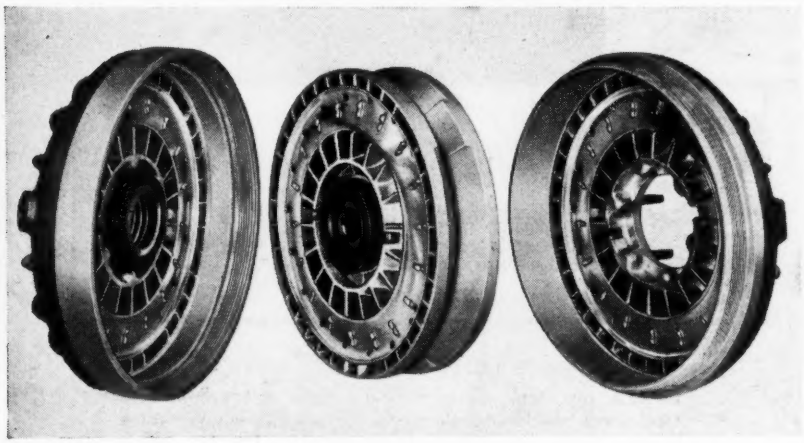


Fig. 1. (Left) Exploded View of Small "Twin Disc" Hydraulic Coupling, Illustrating General Construction. The Outer Shells, when Threaded Together, Form a Twin Impeller. The Runner has Blades on Both Sides which Receive Axial Thrust from Both Sides of the Impeller. Fig. 2. (Right) Assembled "Twin Disc" Coupling Ready for Installation

To obtain additional information on equipment described on this page, see lower part of page 228.

THE CINCINNATI BICKFORD EASY CONTROL

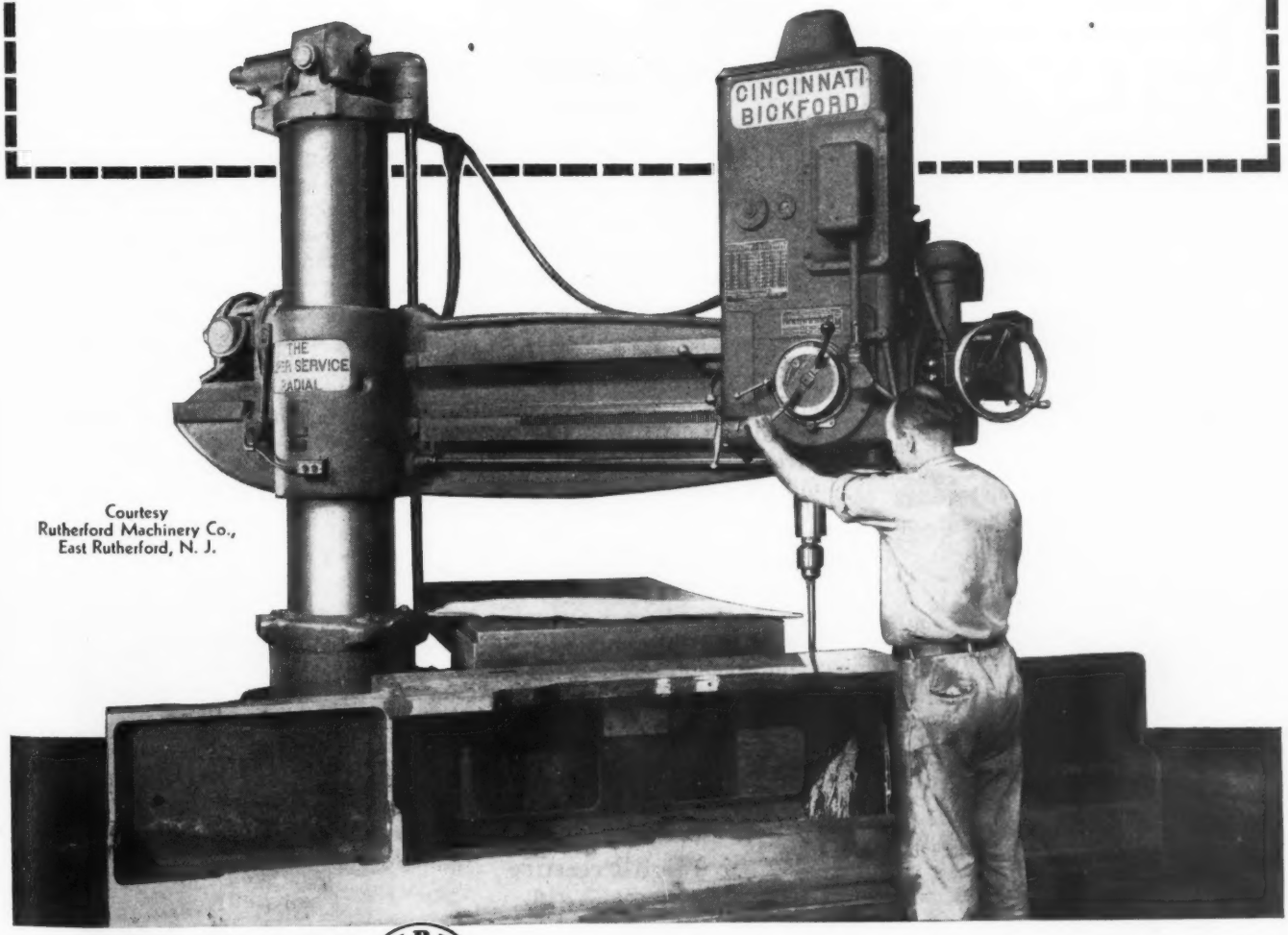
Saved Time here—

The Rutherford Machinery Company, East Rutherford, New Jersey, says: "Our new Cincinnati Bickford Super Service Radial Drill is easy to handle, and very accurate in drilling, reaming, boring and tapping—has increased both our production and accuracy."

Drilling costs were reduced 25% in drilling, reaming and counterboring a total of sixty holes in this 3200-lb. casting.

Write for detailed Bulletin R-24A

See our condensed Catalog in Sweet's File.



Courtesy
Rutherford Machinery Co.,
East Rutherford, N. J.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.

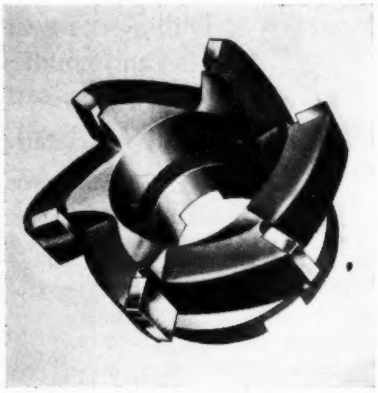
Lincoln "Fleet-Arc" Welder

The Lincoln Electric Co., Cleveland 1, Ohio, has announced a new "Fleet-Arc" alternating-current welder that is said to have many features not previously incorporated in alternating-current welding units. The new welder is equipped with an "Arc Booster," and has been designed to obtain maximum ease of welding, depth of penetration, range of output, economy of operation, safety, and service life. The "Arc Booster" augments the current the instant the arc is struck, the arc being started automatically the moment the electrode touches the work. The addition of this new feature has been accomplished without the use of special high-frequency devices or higher voltage equipment of any kind.

A selector switch on the front of the welder governs the amount of booster current to be used in striking the arc. This provides a complete range of striking intensity to suit requirements in welding thin sheets or heavy plates, making tack welds, or in using various types and sizes of electrodes. The "Arc Booster" has the advantage of enabling the operator to achieve the maximum depth of penetration on each job, and of obtaining maximum penetration depth at the beginning of the weld. Continuous, self-adjusting current control is provided by the rotating reactor control, which affords fast setting throughout the exceptionally wide range of the welder. Quick current control is obtained by simply turning a handwheel. The amperage is indicated on a calibrated dial on the face of the welder.

Thermostatic control, which opens the magnetic starter when overloaded, provides protection for the operator, permits sustained welding at high current values, and prevents damage from overheating. These welders are manufactured in a 200-, 300-, and 500-amperage range, and have both frame and housing of all-welded construction to assure maximum strength and durability. 86

Lincoln "Fleet-Arc" Alternating-current Welder



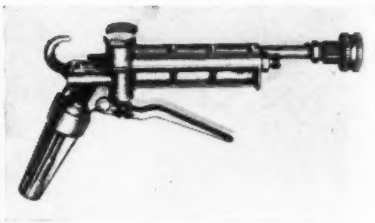
Vascoloy-Ramet Shell End-mill

New Line of Shell End-Mills

The Vascoloy-Ramet Corporation, North Chicago, Ill., has just announced a new line of "Red Streak" carbide-tipped and "Blue Streak" Tantung-tipped shell end-mills manufactured in right- and left-hand styles, ranging in size from 2 1/2 to 4 1/2 inches outside diameter, with bores from 1 inch to 1 1/2 inches. The "Red Streak" carbide-tipped shell end-mills are available with negative radial and axial rake angles for milling steel, and zero rake for milling cast iron and non-ferrous and non-metallic materials. 87

Air and Water Gun for High-Pressure Spray Cleaning

A new light-weight air and water gun designed for high-pressure rinsing and loosening of dirt and grease from inaccessible parts of equipment and machinery has recently been introduced by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif. This gun operates on regular air and water pressures, and can be connected to standard fittings. Merely depressing a single lever releases a high-pressure spray for the cleaning operations. 88



Turco High-pressure Air and Water Gun for Spray Cleaning

Variable Speed Control for Motor

An electronic motor control developed for use on any shunt-wound direct-current motor up to and including 1/2 H.P. for applications where automatic compensation for changing load and changing line voltage is not required has been brought out by the Weltronic Co., 19500 W. Eight Mile Road, Detroit 19, Mich. This unit comprises a small, compact control, including all the necessary features for motor drives on lathes, drill presses, winding machines, milling machines, and similar equipment.

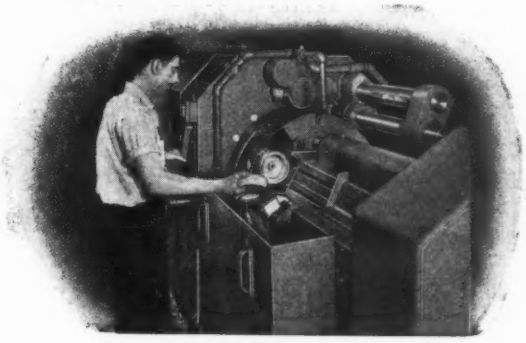
Operation is from a 230-volt, alternating-current, single-phase power source, and the output is for 230-volt direct-current motors. The armature voltage is

Weltronic Variable Speed Control for Motor

To obtain additional information on equipment described on this page, see lower part of page 228.

If you visit the Wico Electric plant

they will probably point out this machine



This progressive manufacturer, ever alert to increasing manufacturing efficiency, sought a better way to machine a rather large and "difficult" magneto housing. There are three different materials in the piece—aluminum die casting, steel bushing and liner, and brass spacer. The tapered hole in the bushing requires a fine finish and close tolerance. The inside diameter of the liners must also be closely maintained.

The housing was formerly turned out on four turret lathes at the rate of 28.8 per hour. New Britain engineers proposed replacing these four lathes with a single Model 695 New Britain chucking machine. Here are the results:

Regular production rate over a six-month period — 102 pieces per hour. Uniformity and over-all quality substantially improved. Cost per piece reduced from 55¢ to 12.8¢. Operator fatigue practically eliminated. Wico management reports that the new machine will pay for itself in less than two years, and completely meets every requirement on this "difficult" piece.

Since the earliest days of automatic machines, the ability of New Britains to reduce production costs and provide a foundation for increased employment has been an important factor in the growth of American manufacturing. This ability, as well as the range of work New Britain automatics can perform, is constantly being expanded by New Britain engineering and research. Why not check over *your* work with the New Britain sales engineer in your locality.

ENGINEERING DETAILS

Fourteen tools are fed in by the main tool slide, and the fact that three different metals are cut at the same time makes the production rate outstanding. To produce the fine finish and close tolerance of the taper bushing hole, two boring, one counter-boring and two taper reaming operations are performed. Two roughing cuts and one finish operation are employed to assure high uniformity and good finish in machining the segment inserts.

LOWER COSTS . . .
KEY TO MORE SALES AND FULL EMPLOYMENT

New Britain

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

continuously variable for speed control from zero to the base speed of the motor.

In addition to a manual speed control knob, a switch on the front of the cabinet provides for forward, reverse, or stop operation. The panel containing the switch and the dial can be removed and installed at a remote location. Accessories include remote forward, reverse, and stop push-button control and dynamic braking in one cabinet; and speed control unit with forward, reverse, and stop switch mounted in separate enclosure. 89

Kennametal Solid Squares for Precision Boring

Kennametal, Inc., Latrobe, Pa., has placed on the market a line of solid Kennametal square tools for the precision boring of steel, cast iron, and non-ferrous metals. These squares are supplied with the bottom side diamond-ground and with a 10-degree angle on one end. They may be ground to any desired tool-point shape.

These tools are available from stock in Kennametal Grade K5H for the precision boring of steel parts, and in Kennametal Grade K6 for machining cast iron. They are regularly supplied in the following sizes: 3/16 or 1/4 inch square by 1 1/4 inches long; 5/16 inch square by 1 1/2 inches long; 3/8 inch square by 1 3/4 inches long; other grades and sizes are obtainable. 90

Kaukauna Portable Universal Drilling and Tapping Machine

A new portable universal horizontal drilling and tapping machine designed by the Kaukauna Machine Corporation, Kaukauna, Wis., combines in one machine the facilities for performing all the operations for which conventional radial and horizontal drilling and tapping machines are regularly employed. The various units of this machine have been designed to save labor and provide maximum operating convenience in performing drilling and tapping operations at any conceivable angle in any plane within the travel range of the units, thus eliminating many costly multiple set-ups and expensive hand drilling and tapping operations. These machines can be easily moved for performing operations on bulky and unwieldy work-pieces, eliminating the expensive, time-consuming transporting and setting up of jobs on fixed machines.

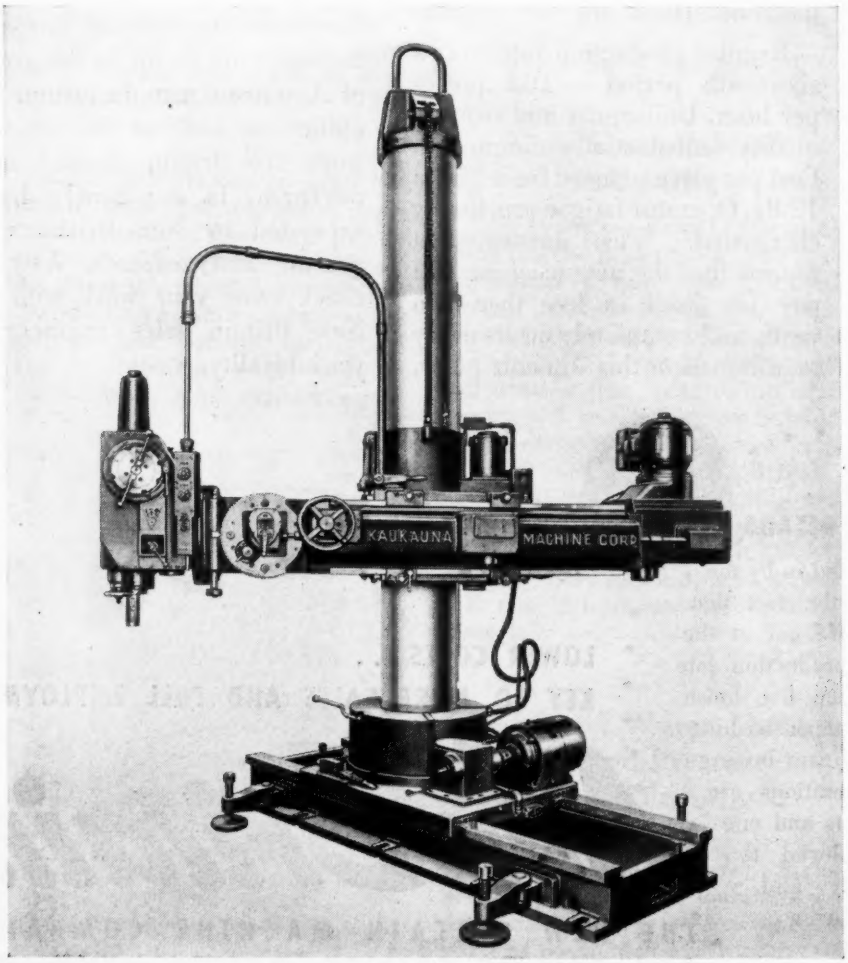


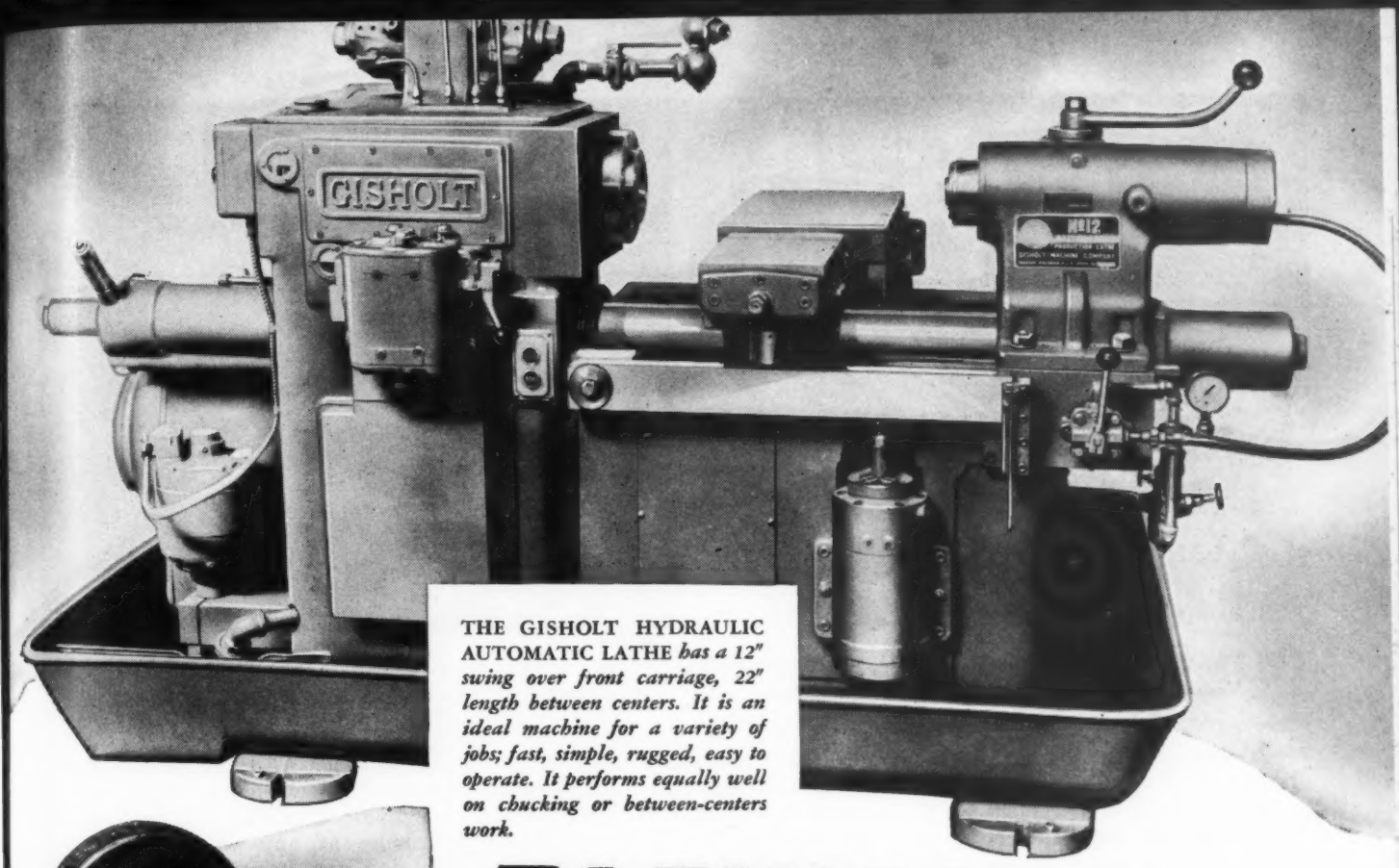
Fig. 1. Kaukauna Portable Universal Drilling and Tapping Machine

An important feature of these universal drilling and tapping machines is the swiveling head which can be rotated 360 degrees in either a horizontal or a vertical plane, as indicated in Fig. 2. Thus, it is possible to operate the spindle at any conceivable angle. The headstock is positioned on two individually controlled axes to permit the head to swivel 360 degrees on a trunnion and the trunnion also to swivel 180 degrees. The two rails supporting the head and trunnion have a 24-inch horizontal traverse, their movement being accomplished through two handwheels with dual hand-clamps for locking the rails in position.

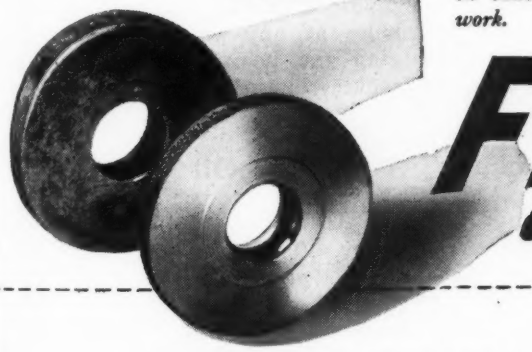
The rails can be raised or lowered by power, and they can be positioned at any suitable point for performing the required operations. They can also be swiveled through 360 degrees about the column to perform machining operations at any point around the machine. Work held on a Kaukauna indexing table, as shown in Fig. 3, can be quickly rotated to present five surfaces to the universal drilling and tapping machine.

The spindle speed unit, located at the ends of the rails, encloses the gearing that controls the spindle speeds. Three spindle feeds are provided, and the drive to the spindle consists of a nine-speed gear-change box, with a direct drive to the spindle through the necessary gears and drive-shaft. The nine speed changes are actuated by dual rotary selector levers, with an indicating dial showing at all times the spindle speed engaged. The levers are located near the head, and are always within easy reach of the operator,

To obtain additional information on equipment described on this page, see lower part of page 228.



THE GISHOLT HYDRAULIC AUTOMATIC LATHE *has a 12" swing over front carriage, 22" length between centers. It is an ideal machine for a variety of jobs; fast, simple, rugged, easy to operate. It performs equally well on chucking or between-centers work.*



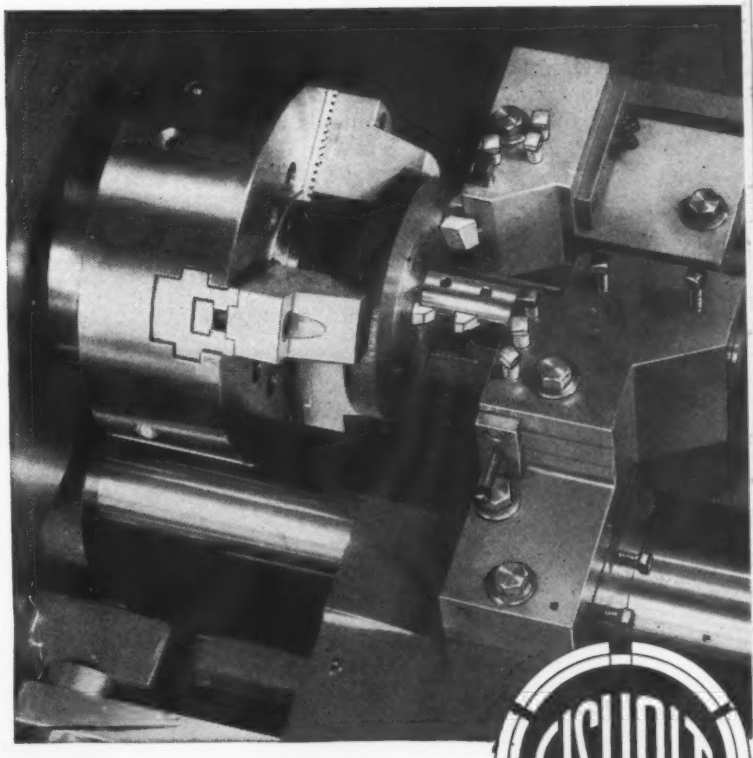
FLEXIBILITY
in an Automatic Lathe

THE GISHOLT HYDRAULIC AUTOMATIC LATHE

Here, with the same basic tooling and slide arrangement, the Gisholt Hydraulic Automatic Lathe handles the machining of *three different types* of pipe flanges: threaded, Van Stone and slip-on. These flanges range from 1¼" to 2½" pipe size. The machine permits either straight or taper boring.

Such extreme flexibility is unique in a machine of this type. It is due to the ease of control and adjustment provided by the Gisholt Hydraulic Automatic Lathe. In setting up or adjusting tools, the operator has complete freedom of arrangement with regard to approach, feed, stop or return. He can do manually what is done by hydraulic pressure during the cycle of the machine.

Flexibility is only one of many outstanding features of this modern automatic lathe. If you have parts to produce in volume, why not learn about all of them? Learn what it can do to maintain accuracy at high speeds and cut your costs.



GISHOLT MACHINE COMPANY
1209 East Washington Avenue • Madison 3, Wis.

Look Ahead ... Keep Ahead ... with Gisholt

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINE

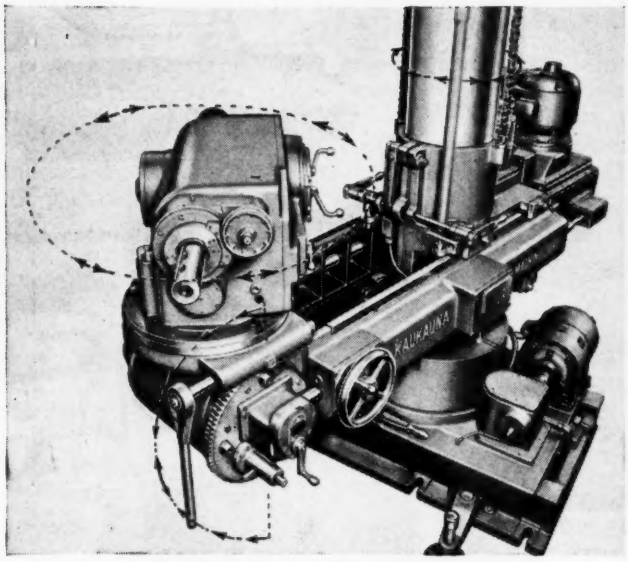


Fig. 2. View of Kaukauna Machine, Indicating Versatile Adjustment Range of Swiveling Head

Fig. 3. Kaukauna Universal Drilling and Tapping Machine Used with Kaukauna Indexing Table

regardless of the position of the head.

A total spindle movement of 36 inches radially from the center of the column is available, since the head is mounted on two horizontal rails which have a 24-inch horizontal adjustment and the spindle has a 12-inch continuous travel. This feature is of particular advantage because it eliminates long overhang of the extension sleeves and holders. To facilitate machining long work-pieces, the column is supported on a traveling column base which has a 48-inch power travel.

Dual controls provide easy access to all machine controls, regardless of the head position. A lifting bail attached to the upper end of the column facilitates quick and easy handling of the machine.

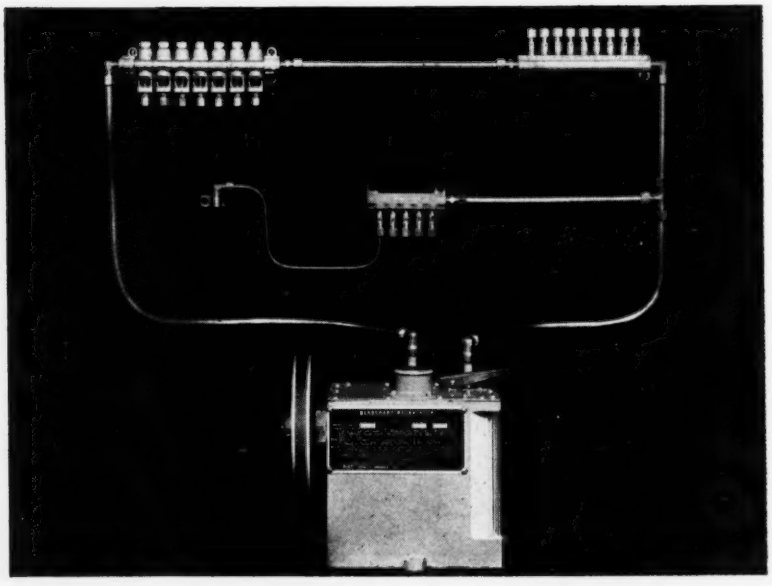
This portable horizontal drilling and tapping machine is made in three models. All three models of this machine, when centered within cylindrical work, will drill or tap holes at any angle without changing the position of either the machine or the work-piece...91

Improved "Pulsolator" Automatic Oil Lubricating Systems

The improved "Pulsolator" automatic oil lubricating systems announced by the Lubrication Division of Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass., can be applied to meet practically any lubricating problems that may arise in the operation of industrial machinery. They are being employed on large punch presses and a variety of machine tools, printing presses, rubber mills, and textile, paper, and plastic machinery.

The "Pulsolator" system can be built as an integral part of a new machine or installed on an existing machine. It consists of a central pumping unit with reservoir, an oil supply line which runs from and returns to the pumping unit, and metering feeders mounted along the oil supply line in proximity to their respective bearings. The size and reservoir capacity of the pumping unit vary with the number of bearings to be lubricated, the feeders that control the oil delivery being the same for all installations.

The standard pumping units with reservoir capacities from 1 quart to 55 gallons are capable of lubricating from one to four hundred individual bearings. Special pumping units are made to fit the peculiarities of any installation. In general, the pumps are of the rotary type and are driven from a shaft on the machine or by an independent electric motor. Small single-shot units are available for



"Pulsolator" Automatic Oil Lubricating System

To obtain additional information on equipment described on this page, see lower part of page 228.

Congratulations

TO THE

Automotive Industry

FOR 50 YEARS OF

OUTSTANDING DEVELOPMENT

● Sidney recognizes the great advance that has been made in production—in design—in utility by that industry and pays tribute to it for outstanding service to the nation.

Sidney, like the automotive industry, has made noteworthy progress in the development of lathes over the past 43 years.

It's a great stride from the cone driven lathe of yesteryear to the latest Continuous Tooth Herringbone geared head machine of today. This new lathe is designed and built with all the power—speed—and rigidity required for the successful use of carbide cutting tools.

With the high production demands of the future in mind —investigate Sidney Lathes for your next investment in precision machine tools. Bulletins on all sizes available.

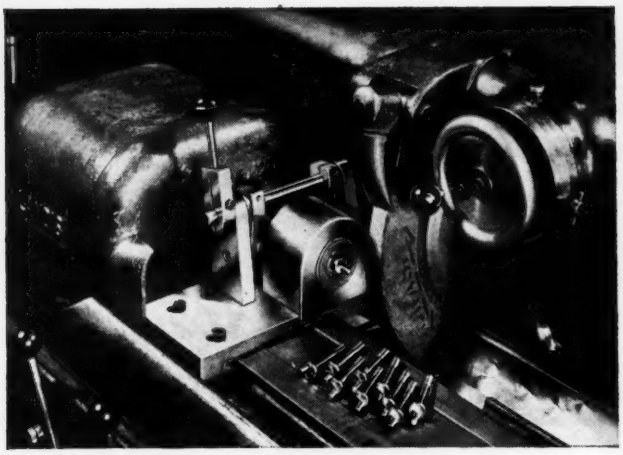
Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904



Special Collet Fixture Brought out by Zagar Tool, Inc.

Variable-speed Drive Placed on the Market by the Flinchbaugh Co.

operation by a solenoid or a lever actuated by a sliding member of the machine.

In operation, the pumping unit circulates a continuous flow of oil through the oil supply line and periodically builds up instants of high pressure, the frequency of which can be selected from once every three seconds to once every twelve minutes. At the instant of high pressure, the feeders mounted along the supply line open and meter predetermined quantities of oil to their respective bearings.

There are two types of feeders —pressure and gravity—each with individual adjustment, so that the quantity of oil metered at the moment of high pressure developed by the pumping unit can be varied from one to three drops. 92

Special Zagar Collet Fixture

A special collet fixture designed to increase the usefulness and step up the production of a standard plain grinding machine has been announced by Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio. This fixture is used to grind parts without centers, which can be held in collets. It runs on its own ball bearings, and is driven by the headstock of the machine. The collet can be opened and closed while the grinder is running. Because the collet does not move lengthwise, it is possible to hold over-all dimensions to close limits.

This collet fixture is easily adaptable to any model of grinder. It can be quickly installed or removed, and its use involves no special attachments. The illustration shows the fixture in operation on a standard Landis machine grinding the eccentric of a crank for a Zagar gearless multiple drill head. The average rate of production has been stepped up to forty cranks per hour by the use of this special fixture, which has a maximum collet capacity of 2 inches. 93

"Dustex" Portable Type Dust Collector

Unlike most tubular-unit dust collectors, which depend solely on the filter tubes to separate the dust from the air, the portable "Dustex" unit brought out by the Dust Filter Co., 1753 W. Lake St., Chicago 12, Ill., separates a high percentage of the dust at the point of intake. A baffle plate beneath the filter tubes causes a rotation of the air and dust in a cyclone manner, which results in depositing the dust in a retaining pan at the bottom of the unit before it has had an opportunity to reach the filter tubes. Consequently, no heavy dust or lint has the opportunity to reach the fifteen 36-inch long filter tubes at the top of the unit, in which all remaining fine dust is collected.

The unit is 4 feet high and approximately 2 feet square. It is equipped with a 1 1/2-H.P., three-phase, 220- to 440-volt motor, and can handle two 4-inch branch pipes. The new model dust collector is recommended for use on buffing, polishing, and grinding machines. 94

Variable-Speed Power Drive

A variable-speed power drive designed to meet any fractional horsepower requirement has been placed on the market by the Flinchbaugh Co., 750 S. Court St., York, Pa. This drive has a range of from 20 to 750 R.P.M. with 1725-R.P.M. motors, and with an additional auxiliary shaft, the speed can be reduced to 4 R.P.M. The base and housing are of aluminum, which reduces the weight of the drive to 12 pounds.

The drive has a universal motor mounting for 1/2-H.P. motors and under. Either direction of shaft rotation can be secured by mounting the motor right or left

Portable Dust Collector Brought out by Dust Filter Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

on the base. The drive can be easily and quickly changed from one piece of equipment to another to meet work requirements.....95

Rubber-Frame Eye-Protecting Goggle

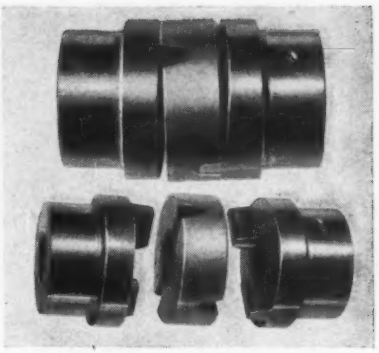
A new rubber-frame goggle equipped with a large, single acetate lens, designed to protect workers against chemical and dust hazards, has been brought out by the American Optical Co., Southbridge, Mass. This company also makes a respirator, which can be worn in combination with the new goggles.

Eye-protecting Goggle Made by American Optical Co.

The goggles provide exceptionally wide-angle vision, and good ventilation, and are said to be comfortable to wear either directly over the eyes or over most types of prescription glasses. The acetate lens is slow-burning, shatter-resistant, and designed to give clear, undistorted vision. 96

Flexible Coupling

A new flexible coupling developed by James Goff, Taunton, Mass., which is based on the gear-tooth principle, is being manufactured by the Industrial Machine Works, Inc., South Hanover, Mass. This coupling has two identical end pieces with involute gear teeth which mate with a center piece containing rack grooves on opposite sides. These grooves are positioned at right angles, so that the coupling provides simultaneous automatic correction for angular and parallel misalignment. The center piece is made of lubricant-impregnated sintered bronze, unless otherwise specified.



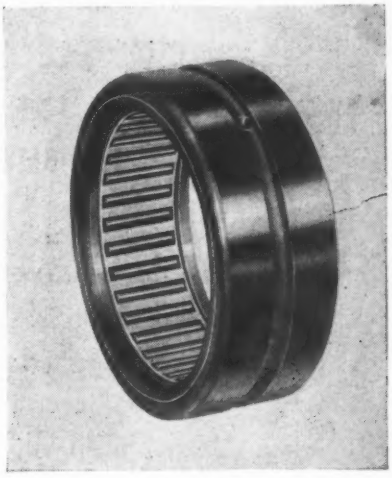
Flexible Coupling Manufactured by Industrial Machine Works

These couplings are suitable for high-speed application, and have a torque capacity in standard sizes up to 1500 inch-pounds. They are made in regular sizes for shafts up to 1 3/4 inches in diameter, but can be made up in special units to suit individual manufacturers' specifications. 97

High-Speed Air-Driven Grinding Attachment for Jig Borers

A high-speed air-driven attachment called the "Vulcanaire," designed to quickly convert jig borers and other machine tools into precision jig grinders, has just been developed by the Vulcan Tool Co., 730 Lorain Ave., Dayton 10, Ohio. This attachment is designed to fit into the chuck of any machine tool. It has controllable speeds ranging from 30,000 to 75,000 R.P.M., from 4 to 8 cubic feet of air per minute being all that is required for the complete speed range. The unit is 2 1/2 inches in diameter, and, exclusive of the adapter and grinding wheel, is 7 1/2 inches long. It is adapted for the precision grinding of holes from 1/16 inch to 1 1/2 inches in diameter. The complete unit includes an adapter to fit any specific machine tool, together with dust collector, air filter, pressure gage, and oiler...98

"Vulcanaire" High-speed Air-driven Grinding Attachment for Jig Borers



Needle Bearing Made by the Orange Roller Bearing Co.

Cage Type Needle Bearing

A new cage type needle bearing designed to assure permanent alignment of the rollers, and thus to obtain smoother operation, has been brought out by the Orange Roller Bearing Co., Inc., 557 Main St., Orange, N. J. This bearing is especially adapted for high-speed spindle applications. It can be used in vertical or overhung applications, and is said to be less affected by misalignment mountings than standard type needle bearings. The rollers run in a cage fabricated from anti-friction, non-ferrous metal.

The cage pockets of this bearing are coined to the contour of the rollers. The cage land revolves on the outer race, preventing the cage pockets from wearing the rollers. All rollers, retaining rings, and race ways are "Pentrate" finished to reduce friction, add durability, and resist rust.

To obtain additional information on equipment described on this page, see lower part of page 228.

NOW, ELECTRONICS GOES TO WORK FOR J&L TO HEAT TREAT COLD FINISHED STEEL UNIFORMLY

Electronics, a fast, powerful, new industrial servant, has been put to work by Jones & Laughlin Steel Corporation in the electric induction heat treatment of cold finished steel bars for the first time by any steel producer. These new "Electreat" steel bars have a degree of uniformity not achieved by conventional furnace heating and tank quenching methods.

In the J&L "Electreat" process each bar is heated and quenched individually in exactly the same length of time as other bars in the lot. This is accomplished through the unusually accurate control of heating and quenching provided by the induction method. Yet "Electreat" bars retain their sectional accuracy and quality surface. Induction heating also keeps to a minimum decarburization which may cause uneven wear in a finished part. "Electreat" bars in a variety of sizes are available in a wide range of quenched and tempered treatments.

Application of induction heating to provide uniform cold finished bars with better physical properties accents J&L's leadership in cold finishing steel, invented by J&L and patented in 1859.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH

"ELECTREAT" STEE

Smart design and production engine step up their production and cut out co heat treating operations by using quenc and tempered cold finished steel for p of autos, domestic appliances, business chines and many other applications. using bars heat treated for them in steel mills they gain advantages of increa strength, ductility, hardness, tough without necessity of heat treating the ished part in their own plants. This removes possibility of distorting the ar after intricate machining work has completed. They now will find that "Electreat" bars give them additional vantage of increased uniformity over ventional heat treated bars.

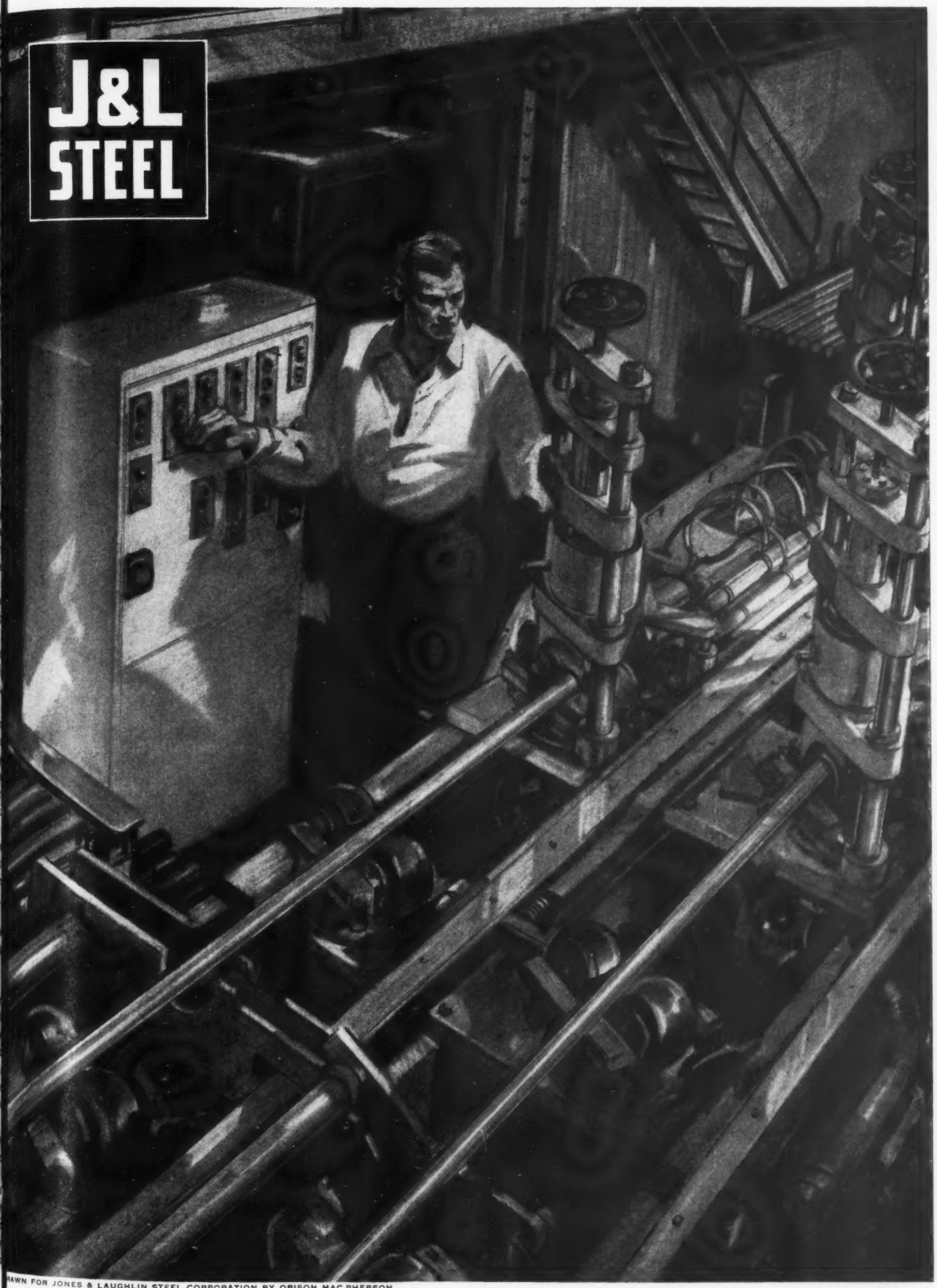
Cold finishing, patented by J&L in 1 improves size accuracy, surface, and ph cal characteristics of hot rolled steel b All the advantages of cold finished s are retained in J&L "Electreat" proc

Electronic principle of transformer is in "Electreat" induction heating meth High frequency electric current flow through a coil transfers to the bar pa through it. The resistance of the bar to current causes heating to take place extreme rapidity. In "Electreat" proc the bars are fed continuously through induction coil. Depending upon their and desired temperature, they are heate 15 to 25 seconds to about 1600 degree The coil itself, which does not come contact with the bar, remains cool. In f you could place your hand inside and feel heat, yet if you had on a metal ri would be melted instantly. When the leave the coil they pass through a con water sprays which strike the steel at h pressure. This produces a rapid rate cooling to harden the steel. In cases wh this more severe quench will fully har the section it may be possible to substit plain carbon steel for a low alloy steel.

Steel can be quenched in many mediu including air, water, brine, molten salts various light and heavy oils.

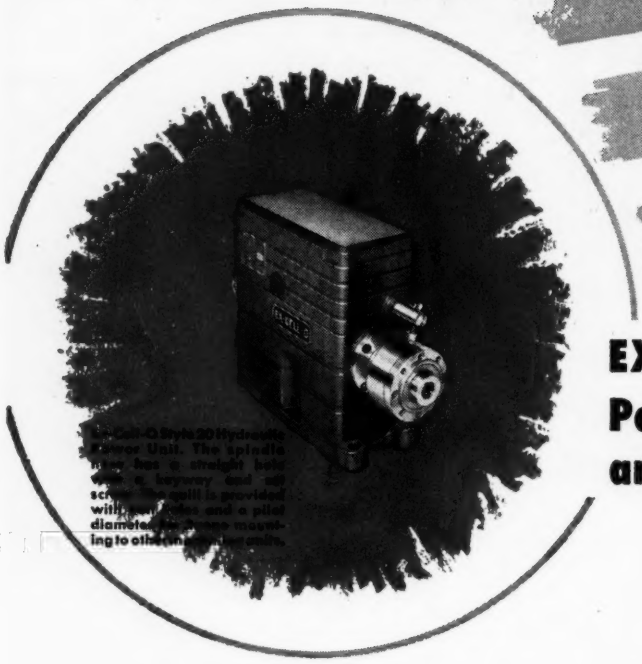
Heat treatment is ancient art, was p ticed by mystics and alchemists of Middle Ages in fashioning armor swords. Centuries later the village smi still depended upon his sense of color his crude but no longer mystic heat tr ment. He heated steel in forge to dull cherry, or orange, plunged it into oil water and determined by filing or scrat ing if steel was quenched to proper hardn

Father of modern heat treating was He le Chatelier (1850-1936) who discove many new facts about the effect of heat and cooling steel. He started the advan ment of heat treating from a hit-and-m art to an exact science.



RAWN FOR JONES & LAUGHLIN STEEL CORPORATION BY ORISON MAC PHERSON

It's New! It's Small! It's Hydraulic!

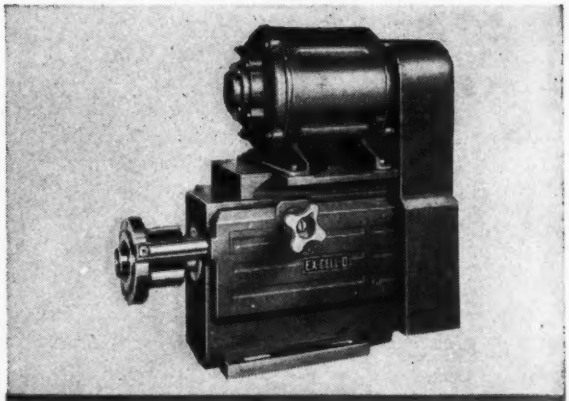


Ex-Cell-O Style 20 Hydraulic Power Unit. The spindle nose has a straight hole and is keyway and set screw driven. A quill is provided with [illegible] and a pilot diameter for close mounting to other [illegible] power units.

EX-CELL-O Style 20 Hydraulic Power Unit for High Spindle Speeds and Fast Operating Cycles . . .

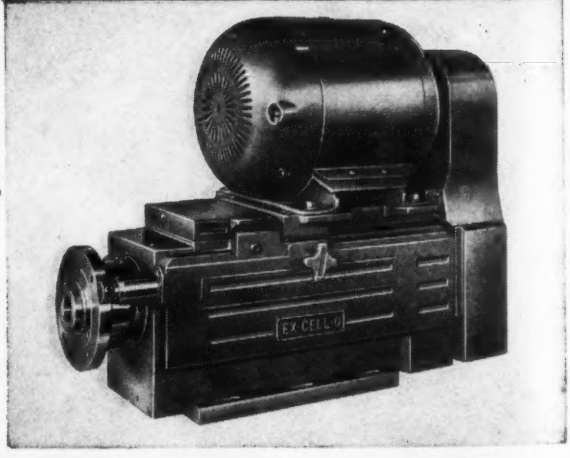
Ex-Cell-O's Style 20 Hydraulic Power Unit is designed for the high spindle speeds required for operating small diameter tools efficiently. It is built to stand up under continuous, fast operating cycles. The automatic cycle includes rapid approach, two infinitely variable dial adjustable feed rates, and rapid return and stop. The unit is arranged for electric start and emergency return control.

All Ex-Cell-O Hydraulic Power Units are easily installed; easily rearranged when production needs change. As a result, it is possible to use the units over and over again, and spread the original cost through years of operation. The units require minimum maintenance; ordinarily, the only care necessary is the replenishing of the hydraulic oil.



TWO OTHER SIZES—MEDIUM AND LARGE

Ex-Cell-O makes two other size hydraulic power units—(above) Style 21 (over-all length, without guard, 22¼") and (below) Style 28-A (over-all length, without guard, 38¼"). They are compact and self-contained for ease in installation. They have infinite feeds for proper cutting and provide ample power for multiple-head operation. Contact your local Ex-Cell-O representative today to see how Ex-Cell-O Power Units fit into your production program.



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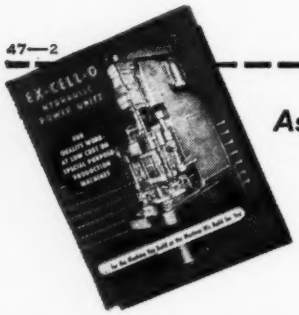


XLO
EX-CELL-O for PRECISION

Ask For This FREE Book Now!

New Ex-Cell-O Bulletin gives full details on all Ex-Cell-O Hydraulic Power Units. Shows how they can be profitably applied to your production problems. Write for a copy today . . . ask for Bulletin No. 45361.

EX-CELL-O CORPORATION

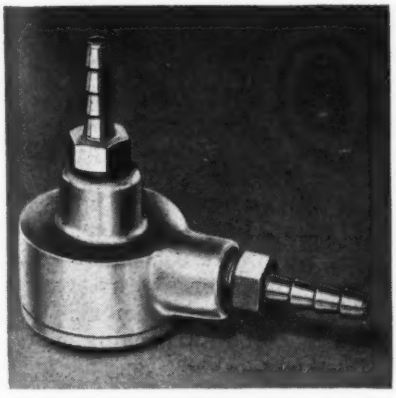
DETROIT 6
MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS • FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES

Rollers are made with square ends to obtain the maximum effective roller length. Internal clearances of this cage type needle bearing can be controlled to meet exacting specifications. These bearings are available in a wide range of shaft sizes. 99

Quick-Action Exhaust Valve for Air Cylinders

The Mead Specialties Co. (Department E.V., 26) 4114 N. Knox Ave., Chicago 41, Ill., has brought out a new kind of quick exhaust valve for use with pneumatic cylinders. The valve acts on the principle of a bellows, expelling the air more quickly and thus materially speeding up the return stroke of the air cylinder. In operation, it opens automatically as soon as the air supply is shut off. It can be attached directly to air cylinders with a 1/4-inch pipe nipple or can be cut into air hose adjacent to the cylinder. 100



Mead Quick-action Exhaust Valve

Electrol Hydraulic Cut-Out Valve

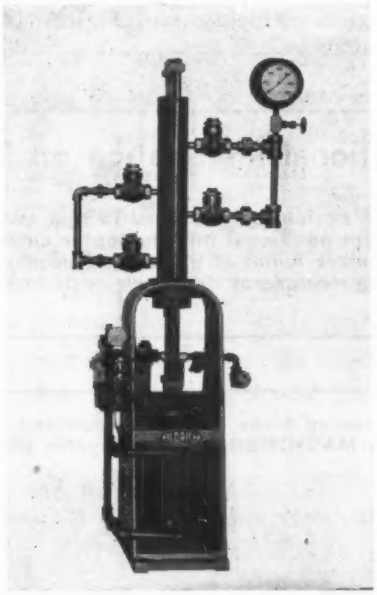
A new hydraulic cut-out valve is being manufactured by Electrol, Inc., 85 Grand St., Kingston, N. Y. Positive seating of the valves, few moving parts, small size, long operating life, low pressure drop, and adaptability to installation in small, narrow, and inaccessible places are features of this valve. The housing is only 1 1/4 inches deep, and in the plan form measures 2 3/4 by 3 1/2 inches. All four ports of the valve are located in the same plane. Three holes for 1/4-inch diameter bolts are provided for easy mounting. Cut-out pressures can be supplied from 300 up to 1500 pounds per square inch, and the differential pressure can be varied in relation to the desired cut-out pressure from 75 to 500 pounds per square inch. An external adjustment for pressure setting is provided. 101

Hydraulic Cut-out Valve Made by Electrol, Inc.

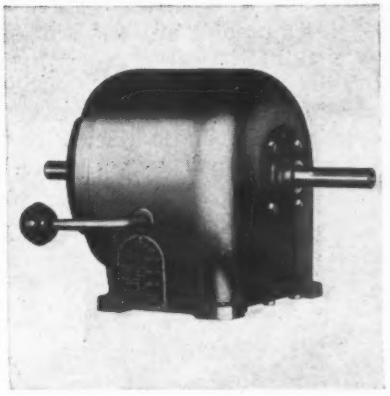
Aldrich-Lytle Hydraulic Pump

A hydraulic pump called the Aldrich-Lytle "Hydropneumatic" power unit is being manufactured by the Aldrich Pump Co., Allentown, Pa. The new unit is a simplex, double-acting hydraulic pump, operated by air pressure from the regular plant line or from a small commercial air compressor. It is designed to provide economical, efficient low-volume high-pressure service for pressure testing and for use with hydraulic presses in small molding press plants.

Various pressures can be obtained with this pump by a simple adjustment of the self-contained, air-pressure reducing valve, hydraulic pressures being maintained without the use of control devices or a by-pass valve. With the proper ratio between the diameters of the air piston and hydraulic plunger, hydraulic pressures up to 20,000 pounds can be obtained with a maximum air pressure of only 100 pounds. The pump, however, is not intended for use where a continuous flow of liquid is required. 102



Air-operated Hydraulic Pump Unit Made by Aldrich Pump Co.



Lima Selective-speed Drive

Lima Selective-Speed Gear-Shift Drive

The Lima Electric Motor Co., 1801 Findlay Road, Lima, Ohio, has announced an addition to its line of selective-speed gear-shift drives. The new drive is designed to motorize machinery requiring selective speeds, and can be used with any standard motor of 1/4- to 1-H.P. rating. The gear ratios of 1 to 1, 1.33 to 1, 2 to 1, and 4 to 1 provide speed changes that occur in even steps.

This four-speed transmission is similar in design to that used on direct motor-driven Lima gear-shift drives. It has a unit cast gear-box designed to provide permanent alignment. The gears and bearings, adequately lubricated by a permanent oil bath, are designed to give long service.

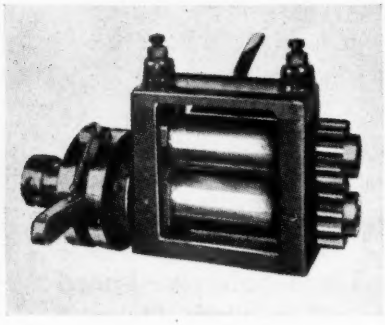
The shift lever is available in four positions. A conveniently located speed selection chart facilitates selection of output speeds.

To obtain additional information on equipment described on this page, see lower part of page 228.

The drive will operate in either direction of rotation. The comparatively small over-all dimensions make the drive especially adaptable to applications where mounting space is limited.....103

Gilbert Friction Roll Feed

An improved small-size friction roll feed for use in feeding stock into a stamping or cutting machine has been placed on the market by the Machine Service Co., 159 Croom St., Providence, R. I. This new roll feed can be easily and quickly reversed. Another advantage is the reduction of slippage to a minimum. Also, this feed is not affected by oil or grease. Tests have shown that the feed can be held to as close as 0.003 inch under all conditions, thus making it satisfactory for precision operations. Stock can be easily inserted between the rollers, as the automatic release relieves pressure and prevents pulling. This feed is particularly adapted for use in the jewelry and allied industries. 104

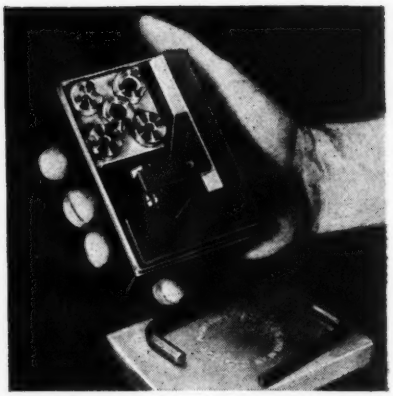


Gilbert Roll Feed Placed on the Market by the Machine Service Co.

Covel Cutter-Grinding Arbors

A set of three arbors, designed with just the right amount of taper to hold cutters and yet permit them to be easily slipped on with only a slight pressure, is being placed on the market by the Covel Mfg. Co., Benton Harbor, Mich. These hardened and ground alloy-steel arbors have lapped centers, the distance between centers being constant for all diameters. The standard set includes one 1-inch, one 1 1/4-inch and one 1 1/2-inch diameter arbor, each 10 inches in length. The set of three arbors packed in a metal box has a shipping weight of 14 pounds. 105

Set of Three Cutter-grinding Arbors Made by Covel Mfg. Co.



McCullough Drill Jig with Interchangeable Bushings and Wrenches

McCullough Drill Jig

A jig for use in drilling accurately positioned holes in parts of any shape or in stock up to 2 inches in diameter has been placed on the market by the McCullough Mfg. Co., 12709 Gratiot Ave., Detroit 5, Mich. It consists of an L-shaped member with work-locating vee in the upper side of the base; a sliding bushing-holding member, which can be adjusted to clamp the work in place; and a set of six drill bushings, ranging in size from 1/16 to 3/8 inch.

The jig is 4 1/2 by 3 by 1 1/2 inches in size. It has a pivoted link construction which prevents springing or binding of the jaw. Tapped holes are provided in the jig for attachment to a table when handling production work and for the mounting of attachments for angular drilling operations. 106

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

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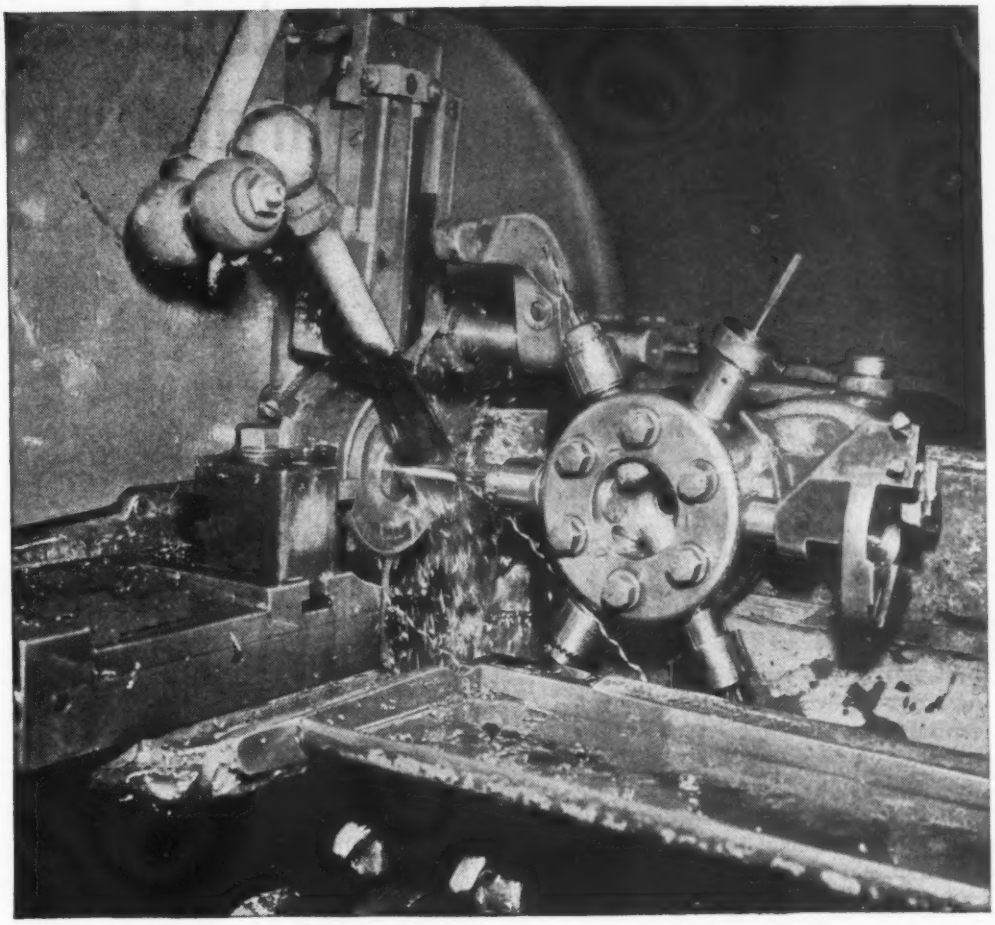
Cut Metal Better and Faster at Lower Cost



LONGER TOOL LIFE

LOWER cost, as a result of longer tool life, is one of the important advantages you can depend on when you use *Texaco Cutting and Soluble Oils. "Drill life increased from 15 to 70 pieces,"* says one user. Another reports *drill life tripled.* And similar outstanding results are reported for other machine tools of all kinds.

Texaco Cutting, Soluble and Grinding Oils effectively lubricate and cool. They prevent chip welding and wheel loading — assuring more cuts per tool grind. They also permit faster cutting and assure a finer finish.

Whatever the metal or method of machining it, there are *Texaco Cutting, Soluble and Grinding Oils* made to assure greater output, better quality, fewer rejects, and lower costs.

Get the Texaco oils you need, plus specialized Lubrication Engineering Service, by calling the nearest of the more than 2300 Texaco distributing plants in the 48 States.

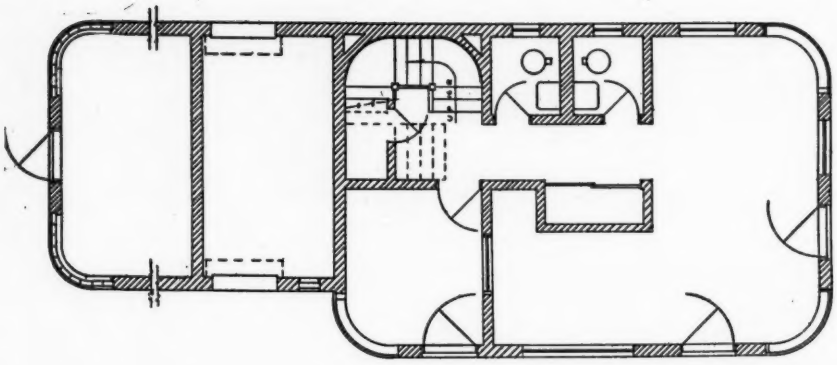
Or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, SOLUBLE AND GRINDING OILS FOR FASTER MACHINING

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

Save time, labor, materials with these short cuts in drafting!



1. UNNECESSARY DRAFTING ELIMINATED

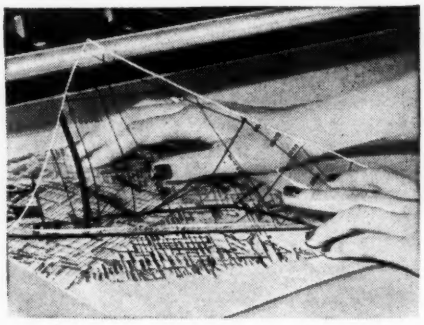
Assume that you want additional tracings of the above floor plan so that you can add the plumbing layout to one copy, the air-conditioning layout to the next, and so on.

With Ozalid, you need never redraw your original tracing! Just make translucent Ozalid Intermediate prints of it . . . and on these, add the individual details in pencil or ink. Then from each "Intermediate" you can produce the desired number and type of positive OZALID PRINTS.

This is just one example that probably suggests dozens of uses for Ozalid in your everyday work!

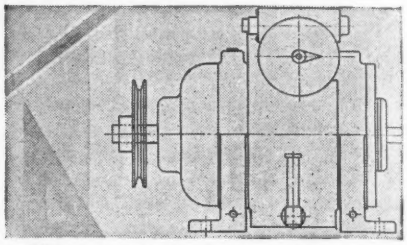
2. SEPARATE DESIGNS COMBINED

The extreme transparency of Ozalid foil permits the production of composite prints, which are generally made to show the relationship of separate design details to each other.

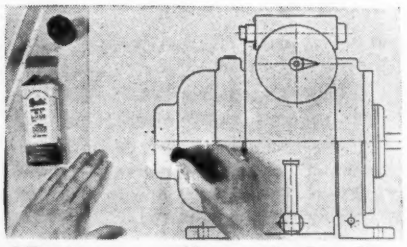


To do this, you merely make a foil print of each tracing . . . then overlay the foils in the desired position on Ozalid sensitized material . . . and feed into your Ozalid machine.

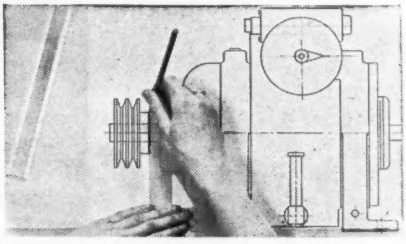
3. OBSOLETE DETAILS REMOVED



• This is an Ozalid Intermediate (translucent) print of the original drawing.



• Draftsman eradicates obsolete lines with quick-drying OZALID CORRECTOR FLUID.



• New design is drawn in. Any number of prints can now be made from this up-to-date "Master."

SEE the 10 different types of Ozaprints you can make. *Learn* all about the new Ozalid Streamliner! Write today for free booklet No. 199.

NEW OZALID STREAMLINER

. . . Designed for Average Printmaking Requirements!

This completely new, moderately priced machine gives you these five extra values in *printmaking* at no extra cost—

Efficiency: You get positive (not negative) prints direct from your tracings in *two* simple steps: Exposure and Dry Development.

Speed: Your prints are delivered completely dry, ready for use in only 25 seconds.

Economy: An 8½ x 11" print costs one cent; 11 x 17", two cents. You can make prints up to 42 inches wide, any length. Your Streamliner requires only 11 sq. feet of floor space.

Versatility: The lines and images on your originals can be reproduced in black, blue, red, sepia, yellow . . . on paper, cloth, foil, film, or plastic. All prints are made in *same manner* . . . simply choose type of Ozalid material best for job at hand.

Simplicity: Anyone can be the operator. Prints are delivered on top, stacked in order, within easy reach.

OZALID

DIVISION OF GENERAL ANILINE AND FILM CORPORATION

Johnson City, N. Y.

Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 232 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January, 1947, Number of MACHINERY

Carbide and Cast-Alloy Cutting Tools and Dies

JESSOP STEEL CO., Washington, Pa. Catalogue illustrating and describing Jessop "Malta" cemented-carbide and "T and V" non-ferrous, cast-alloy tools, dies, and wear-resisting parts. Copies can be obtained without charge if requested on a company letterhead, addressed directly to the Jessop Steel Co.

Center Drilling Machines

DETROIT TAP & TOOL CO., 8432 Butler Ave., Detroit 11, Mich. Bulletin DCD-1, descriptive of this company's new design of center drilling machine. Copies can be obtained without charge if requested on a company letter-head, addressed directly to the Detroit Tap & Tool Co.

Chain Hoists

CHESTER HOIST CO., Lisbon, Ohio. Catalogue G-558, covering this company's line of chain hoists, including instructions for care and use. Copies can be obtained if requested on a letterhead addressed to the company.

Milling Practice

CINCINNATI MILLING AND GRINDING MACHINES, INC., Cincinnati 9, Ohio. Bulletin M-1427, "The Inclination of the Cutting Edge and its Relation to Chip Curling"; M-1455, "Initial Contact of Milling Cutter and Work-piece"; M-1477, "Automatic Milling Control Systems"; M-1478, "New Methods of Analysis of Machining Processes"; and M-1496, "Speed and Feed Selection in Carbide Milling with Respect to Production, Cost, and Accuracy." 1

Welding Machines

FEDERAL MACHINE & WELDER CO., 212 Dana St., Warren, Ohio. Bulletins No. 4620, descriptive of Federal automatic spot and projection welders; No. 4625, on Type P automatic projection welders; No. 4640, on portable gun type welders; and No. 4650, illustrating and describing Type S longitudinal, circular, and universal seam welders. 2

Machine Scale Models for Plant Lay-Out

TRIOMETRIC ENGINEERING CO., 1160 Wolfendale St., Pittsburgh 12, Pa. Price list 142, covering Triometric cast-metal scale models of machines and plant equipment, designed for use in laying out production equipment in a plant to insure maximum economic production. 3

Formed Bushings and Bearings

NATIONAL FORMETAL CO., INC., 6664 Metta Ave., Cleveland 14, Ohio. Catalogue containing data, of value to designers, engineers, and users, on Formetal "superformed" bushings and bearings and spacer tubes, including applications, material specifications, tolerances, sizes, etc. 4

Low-Temperature Welding Rods

EUTECTIC WELDING ALLOYS CORPORATION, 40 Worth St., New York 13, N. Y. Pamphlet ET-1-47, entitled "Arc-Welding at Lower Base Metal Temperatures," describing the new metal arc electrodes known as "LowTemp EutecTrodes." 5

Alternating-Current Welders

WESTINGHOUSE ELECTRIC CORPORATION, P.O. Box 868, Pittsburgh 30, Pa. Booklet B-3548, covering construction details, electrical specifications, and application data for the complete line of alternating-current transformer type welders made by the corporation. 6

Circular Sawing Machines

MOTCH & MERRYWEATHER MACHINERY CO., Penton Bldg., Cleveland 13, Ohio. Bulletin illustrating and describing the company's new No. 00 circular sawing machine for cutting 1/4- to 2-inch stock; also describes the "Triple-Chip" saw blade and automatic saw grinding machine. 7

Micro Drill Chucks

CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago 10, Ill. Folder descriptive of the "Micro-Chuck," an adjustable collet drill chuck designed so that it can be adjusted to absolute concentricity for precision work with small-diameter drills, such as watchmakers' tools. 8

Hydraulic Power Units

EX-CELL-O CORPORATION, Detroit 6, Mich. Bulletin 45361, containing engineering information, installation drawings, and application photographs of three sizes of Ex-Cell-O hydraulic power "Package Units" for feeding and rotating cutting tools. 9

Material-Handling Equipment

RAPIDS-STANDARD CO., INC., Department SH-119, 308 Peoples National Bank Bldg., Grand Rapids 2, Mich. Bulletin describing

the "Rapid-Wheel" gravity-conveyor spur curve and gravity-conveyor hinged section and their use in a conveyor installation.....10

Hardening and Quenching Installation

W. S. ROCKWELL CO., 200 Eliot St., Fairfield, Conn. Data Sheet RF-1, describing a Rockwell installation in a drop-forging plant for the automatic, continuous hardening, quenching, washing, and drawing of steel forgings...11

General-Utility Tool

TEMPLETON, KENLY & CO., 1020 S. Central Ave., Chicago 44, Ill. Bulletin P&P 46, descriptive of the Simplex "Util-A-Tool" for pulling, pushing, bending, lifting, and many other operations required in maintenance, repair, and production jobs. 12

Indicating and Controlling Instruments

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia 44, Pa. Catalogue 15-10, descriptive of the new "Electronik" strip chart potentiometers for temperature recording and control.....13

Mechanical Pressure Gage

W. C. DILLON & CO., INC., 5410 W. Harrison St., Chicago 44, Ill. Circular descriptive of the new Dillon mechanical pressure gage, especially designed to measure pressures or working loads in inaccessible machine set-ups. 14

Management Control

REMINGTON RAND, INC., Systems Division, 315 Fourth Ave., New York 10, N. Y. Bulletin entitled "Dynamic Management Control with 'Sched-U-Graph,'" showing how to get maximum production from plant facilities.....15

Instructions for Pouring Babbitt Bearings

JOSEPH T. RYERSON & SON, INC., Chicago, Ill. Illustrated wall chart, showing the necessary steps to follow in pouring babbitt bearings so as to obtain good tightly lined bearings. 16

Hand Screw Machines

MONARCH MACHINE TOOL CO., Sidney, Ohio. Bulletin 1901, illustrating and describing the new "Speedi-Matic" high-production hand-operated screw machine, designed to handle small machine work.....17

Small Induction Furnaces

AJAX ELECTROTHERMIC CORPORATION, Ajax Park, Trenton 5, N. J. Bulletin 12-A, descriptive of Ajax-Northrup 3- and 6-K.W. converter type induction furnaces for heating, brazing, hardening, and melting. 18

Stamping and Trimming Machines

WHITING CORPORATION, QUICKWORK DIVISION, Harvey, Ill. Bulletin QW-121, covering the operation, application, and specifications of the Quickwork-Whiting stamping trimmer. 19

Materials-Handling Equipment

METZGAR CO., Grand Rapids 4, Mich. Circular on the Metzgar line of gravity conveyors, endless belts, truck and trailer wheels, and other materials-handling equipment. 20

Cutting Oils for Automatics

SUN OIL CO., Philadelphia 3, Pa. Folder A-1422, recording eleven different case histories of parts produced on automatic machines, using "Sunicut 11," a sulphurized cutting oil. 21

Production Engineering

GEORGE FRY & ASSOCIATES, 135 S. LaSalle St., Chicago 3, Ill. Bulletin entitled "Production Decalog," outlining ten essential elements of an effective production engineering program. 22

Welding Technique

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Revised edition of bulletin W-2A entitled, "Ampco-Trode Welding Technique," covering the welding of aluminum-bronze alloys. 23

Resistors

RESISTORS, INC., 2241 S. Indiana Ave., Chicago 16, Ill. Catalogue containing complete specifications and application data on the line of resistors and windings made by this company.....24

Micrometers

SWEDISH GAGE CO. OF AMERICA, 8900 Alpine Ave., Detroit 4, Mich. Catalogue on this company's precision micrometers. 25

Ferrous-Alloy Castings

ADVANCE FOUNDRY CO., 121 Seminary Ave., Dayton 3, Ohio.

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (January, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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BUSINESS ADDRESS.....

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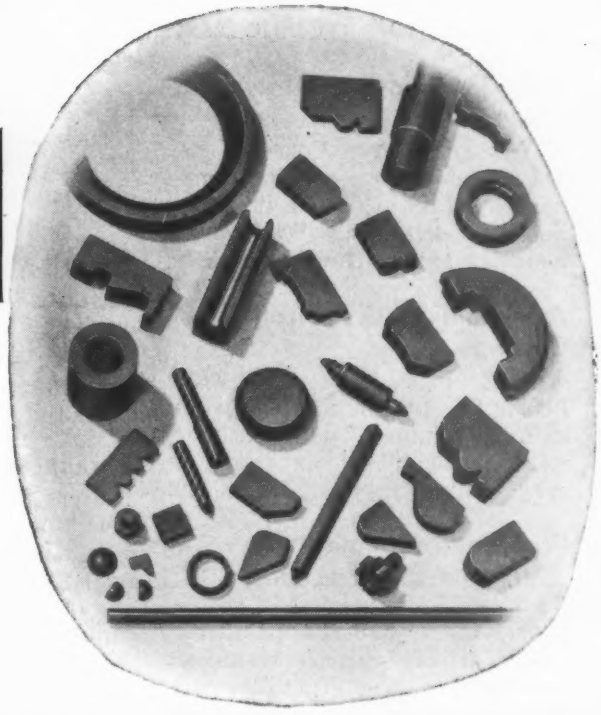
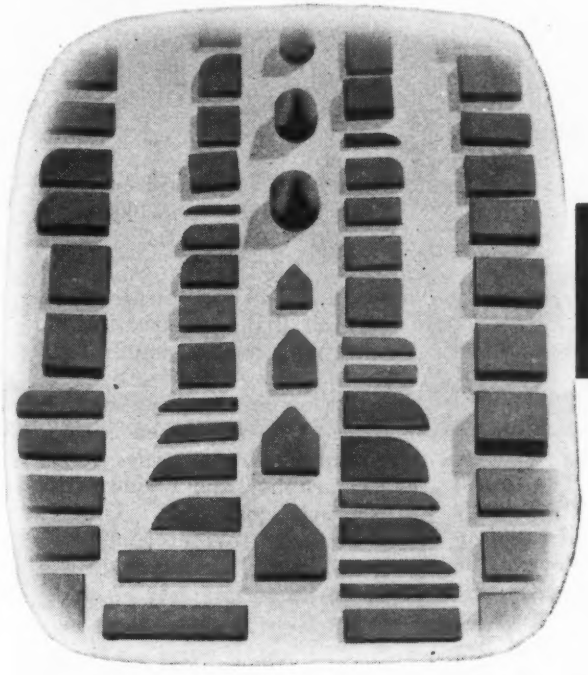
CARBOLOY (TRADEMARK) CEMENTED CARBIDE BLANKS *for every need!*

SPECIALS *in any shape or size*



Carboloy Cemented Carbide specially-shaped blanks are ideal for tips or inserts on tools, gages, cams, guides, work rests, or any part of your product subject to abrasive wear. Made to your exact specifications, they are supplied ready for use—following any brazing or grinding necessary. (For quotation on blanks for your needs, send detailed drawings.)



STANDARDS *as low as 9¢ each*

Standard Carboloy Cemented Carbide Blanks cover *up to 80%* of your carbide tool needs! In fact, just a small inventory of these low-cost blanks equips you for speedy tool-up on a wide range of average jobs. Available in grades for cutting steel, cast-iron, non-ferrous metals, and non-metallics . . . and in a wide range of sizes. Prices surprisingly low—over 50% of them priced between 9c and 73c! Stocked coast-to-coast for prompt delivery. Send for Catalog GT-175R today.

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IN 73 CITIES Coast To Coast

Booklet illustrating numerous examples of Strenes metal castings, including drawing and forming dies for a variety of uses.....26

Injection Molding of Plastics

TENNESSEE EASTMAN CORPORATION, Kingsport, Tenn. Bulletin entitled "Tenite Injection Molding," containing specific instructions for the injection molding of the thermoplastic "Tenite." 27

Hole Punching and Notching Equipment

WALES - STRIPPIT CORPORATION, 345 Payne Ave., North Tonawanda, N. Y. Circular illustrating and describing Wales hole punching and notching units.....28

Arc-Welding Gray Iron Castings

C. E. PHILLIPS & Co., 2750 Poplar St., Detroit 8, Mich. Bulletin containing instructions for making machinable arc welds in gray iron castings. 29

Protective Goggles

MINE SAFETY APPLIANCES Co., Braddock, Thomas, and Meade Sts., Pittsburgh 8, Pa. Bulletin CE-29, listing various styles of protective goggles for different classes of work. 30

Protective Packaging

R. M. HOLLINGSHEAD CORPORATION, Camden, N. J. Circular descriptive of "Cocoon" protective packaging for machine equipment of any size, from a ball bearing to a locomotive. 31

Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 10, describing a variety of applications of Meehanite castings to high-pressure work. 32

Diamond Tools

CHAMPION DIAMOND Co., INC., 551 Fifth Ave., New York 17, N. Y. Circular showing the various diamond tools manufactured by this concern for dressing grinding wheels. 33

Motor Maintenance Tools

HOLUB INDUSTRIES, INC., Sycamore, Ill. Catalogue descriptive of the company's line of motor maintenance tools. 34

Push-Pull Controls

AMERICAN CHAIN & CABLE Co., INC., AUTOMOTIVE AND AIRCRAFT DIVISION, Detroit, Mich. Catalogue showing various applications of "Tru-Lay" push-pull controls.....35

Material-Handling Equipment

REVOLVATOR Co., North Bergen, N. J. Bulletin 145, showing various types of Revolvators and other machines for horizontal and vertical moving. 36

Force-Feed Lubricators

MANZEL BROTHERS Co., 309 Babcock St., Buffalo 10, N. Y. Catalogue G, on Manzel force-feed lubricators.....37

Ampco-Metal Centrifugal Castings

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 53A, entitled "Ampco-Metal Centrifugal Castings." 38

Rebuilt Machine Tools

MILES MACHINERY Co., Saginaw, Mich. Catalogue 184, listing rebuilt, guaranteed machine tools available for prompt delivery.....39

Milling Machines

CHILDS & Co., Conneaut, Ohio. Leaflet descriptive of this company's No. 0000 knee type milling machine. 40

* * *

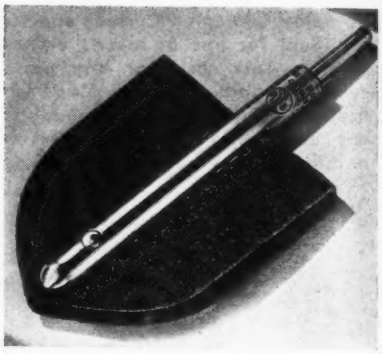
Allegheny Ludlum Awards

The Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., has recently instituted a new award in recognition of distinguished service and outstanding achievement of its employes. The award consists of the "President's Medal," a certificate, and $1000 in cash. Among the employes who were recently honored with this award were: Vere B. Browne, vice-president in charge of research and a member of the board; Walter M. Patterson, manager of the electric furnace department at the company's Brackenridge mill; David P. Bartell, chief chemist at Brackenridge; and Walter Miscosky of the Brackenridge Chemical Laboratory. Mr. Bartell and Mr. Miscosky shared the award, which was presented to them for "extraordinary accomplishments in reducing the time required to determine the chemical analysis of alloy steels."

Abrading Pads for Finishing Internal and External Surfaces

The Wilkinson Equipment Co., 109 E. 69th St., Chicago 37, Ill., has recently been appointed sales distributor for RB abrading pads developed for use in finishing interior and exterior surfaces. These pads are made from two to fourteen plies of abrasive material, die-cut in four standard shapes, which come in sizes from 1/2 inch by 2 inches up to 9 by 10 inches to accommodate openings from 1/4 inch to 6 1/2 inches in diameter. They are supplied in a grit range of from 24 to 320.

When attached to the driving mechanism of any lathe, drill



Abrading Pad Placed on the Market by the Wilkinson Equipment Co.

press, flexible shaft, or air or electric hand drill by either an external or internal mandrel, the abrading pads can be used for cleaning or polishing metal, wood, plastics, cast or pressed composition materials, glass tile, plaster, cement, rubber, and a wide variety of synthetic materials. They can also be used for internal grinding, deburring, chamfering, etc.

* * *

German equipment that produced deadly projectiles for use against the United States Army tanks during the war will soon serve to advance American research in powder metallurgy. This equipment will be installed in a newly constructed building at Stevens Institute of Technology. It will form the basis of a Navy sponsored research program on high-temperature alloys which are important in the development of jet-propelled airplanes and rockets.

Cutting Better Threads...Faster

SUNICUT 196...

Speeds Up Threading of Automatic Sprinkler Pipes, Improves Quality of Threads

Here is a case where a big manufacturer of automatic fire-sprinkler systems increased production and improved his threads by replacing a special, expensive oil with Sunicut 196.

Machine: No. 5 Landis Pipe-Threading Machine.
Operation: Threading ⅜" to 8" Pipe. **Lubricant:** Sunicut 196.

In this case, a saving of 15% in oil costs resulted. This is a typical example of how Sun's "Job-Proved" cutting oils have aided in speeding up production and in reducing costs.

Machine-tool operators prefer Sunicut because it is a clear, transparent, free-flowing, sulphurized mineral oil. Sunicut is recommended for those exacting jobs where an emulsifiable cutting oil is not suitable.

Other "Job-Proved" Sunicut grades are suitable for use on automatic lathes, gear-cutters, etc. Contact the nearest Sun office for recommendations.

SUN
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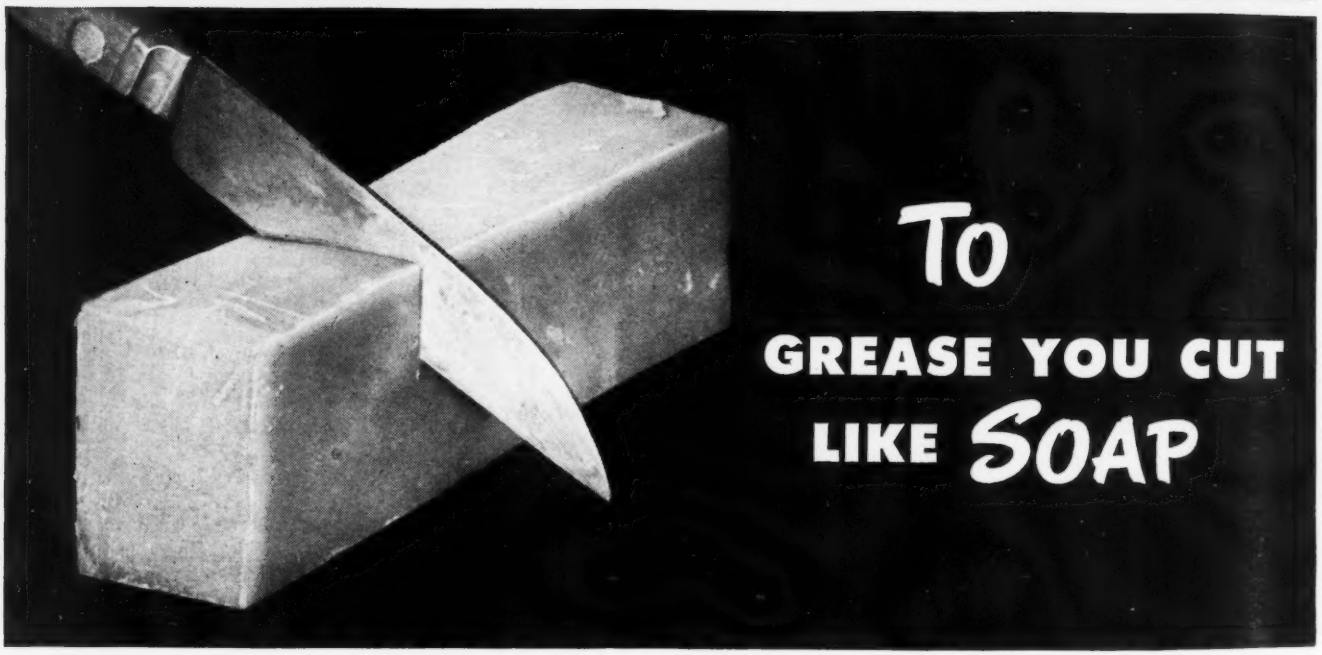
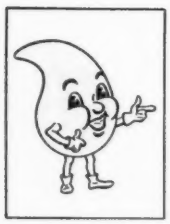
INDUSTRIAL
PRODUCTS

SUN OIL COMPANY · ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas





It is a fact that certain Shell *greases* for high-speed bearings are more fluid than heavy grades of lubricating *oil* . . . and that other Shell greases are solid "block" lubricants that are sliced up in bricks to be placed in the journals of heavy machinery.

It is also a fact that fluidity is just one of the factors a Shell Lubrication Engineer takes into account when he selects lubricants for your equipment. His stock in trade is a lubricant to meet your every need . . . his function is to select the right one for each job.

From his experience, the Shell Lubrication Engineer can help you when something's wrong and needs quick attention—and he can help prevent trouble by analyzing your equipment right now to see that you are getting the benefit of all that's new in lubrication.

Call him any time. He's a good man to know.

SHELL

SHELL OIL COMPANY, Incorporated
50 West 50th Street, New York 20, New York
100 Bush Street, San Francisco 6, California

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—3

Odd Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
5	6.8485	6.8639	6.8800	6.9202	6.9691
7	8.9555	8.9679	8.9822	9.0199	9.0675
9	11.0189	11.0285	11.0410	11.0762	11.1224
11	13.0615	13.0686	13.0795	13.1126	13.1575
13	15.0925	15.0973	15.1068	15.1381	15.1819
15	17.1163	17.1190	17.1273	17.1570	17.1998
17	19.1351	19.1360	19.1432	19.1716	19.2136
19	21.1505	21.1498	21.1561	21.1832	21.2245
21	23.1634	23.1611	23.1665	23.1926	23.2334
23	25.1743	25.1707	25.1754	25.2005	25.2408
25	27.1836	27.1788	27.1828	27.2071	27.2469
27	29.1918	29.1859	29.1892	29.2128	29.2522
29	31.1990	31.1920	31.1948	31.2177	31.2568
31	33.2053	33.1974	33.1997	33.2220	33.2607
33	35.2110	35.2021	35.2041	35.2258	35.2642
35	37.2161	37.2065	37.2079	37.2292	37.2674
37	39.2208	39.2104	39.2115	39.2323	39.2702
39	41.2249	41.2138	41.2147	41.2349	41.2726
41	43.2287	43.2170	43.2174	43.2374	43.2749
43	45.2323	45.2199	45.2200	45.2396	45.2769
45	47.2355	47.2226	47.2224	47.2417	47.2788
47	49.2385	49.2251	49.2246	49.2435	49.2805
49	51.2413	51.2273	51.2266	51.2452	51.2820
51	53.2439	53.2294	53.2284	53.2468	53.2835
53	55.2463	55.2313	55.2302	55.2483	55.2848
55	57.2485	57.2331	57.2318	57.2497	57.2861
57	59.2506	59.2348	59.2333	59.2509	59.2872
59	61.2526	61.2363	61.2347	61.2521	61.2883
61	63.2545	63.2378	63.2360	63.2532	63.2893
63	65.2562	65.2392	65.2372	65.2543	65.2902
65	67.2579	67.2406	67.2383	67.2553	67.2911
67	69.2594	69.2419	69.2394	69.2562	69.2920
69	71.2609	71.2431	71.2405	71.2571	71.2928
71	73.2623	73.2442	73.2414	73.2579	73.2935
73	75.2636	75.2452	75.2423	75.2586	75.2942
75	77.2649	77.2462	77.2432	77.2594	77.2949
77	79.2661	79.2472	79.2440	79.2601	79.2955
79	81.2673	81.2481	81.2448	81.2607	81.2961
81	83.2684	83.2490	83.2456	83.2614	83.2967
83	85.2694	85.2498	85.2463	85.2620	85.2972
85	87.2704	87.2506	87.2470	87.2625	87.2977
87	89.2714	89.2514	89.2476	89.2631	89.2982
89	91.2723	91.2521	91.2482	91.2636	91.2987
91	93.2732	93.2528	93.2489	93.2641	93.2991
93	95.2741	95.2534	95.2495	95.2646	95.2996

MACHINERY'S Data Sheet No. 577, January, 1947 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING EXTERNAL GEAR SIZES BY MEASUREMENT OVER WIRES—4

Odd Numbers of Teeth

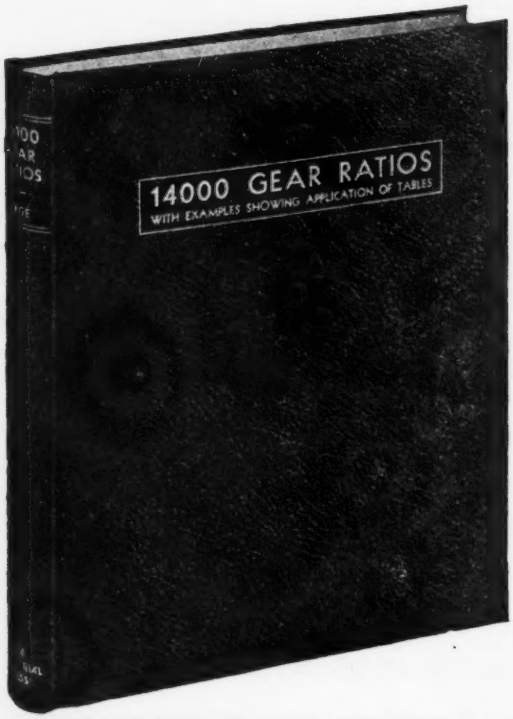
No. of Teeth	Pressure Angle				
	14½°	17½°	20°	25°	30°
95	97.2749	97.2541	97.2500	97.2650	97.3000
97	99.2757	99.2547	99.2506	99.2655	99.3004
99	101.2764	101.2553	101.2511	101.2659	101.3008
101	103.2771	103.2558	103.2516	103.2663	103.3011
103	105.2778	105.2563	105.2520	105.2667	105.3015
105	107.2785	107.2568	107.2525	107.2671	107.3018
107	109.2791	109.2573	109.2529	109.2674	109.3021
109	111.2798	111.2578	111.2533	111.2678	111.3024
111	113.2804	113.2583	113.2537	113.2681	113.3027
113	115.2809	115.2588	115.2541	115.2684	115.3030
115	117.2815	117.2592	117.2544	117.2687	117.3033
117	119.2821	119.2596	119.2548	119.2690	119.3036
119	121.2826	121.2601	121.2552	121.2693	121.3038
121	123.2831	123.2605	123.2555	123.2696	123.3041
123	125.2836	125.2608	125.2558	125.2699	125.3043
125	127.2841	127.2612	127.2562	127.2702	127.3046
127	129.2846	129.2615	129.2565	129.2704	129.3048
129	131.2851	131.2619	131.2568	131.2707	131.3050
131	133.2855	133.2622	133.2571	133.2709	133.3053
133	135.2859	135.2626	135.2574	135.2712	135.3055
135	137.2863	137.2629	137.2577	137.2714	137.3057
137	139.2867	139.2632	139.2579	139.2716	139.3059
139	141.2871	141.2635	141.2582	141.2718	141.3060
141	143.2875	143.2638	143.2584	143.2720	143.3062
143	145.2879	145.2641	145.2587	145.2722	145.3064
145	147.2883	147.2644	147.2589	147.2724	147.3066
147	149.2887	149.2647	149.2591	149.2726	149.3068
149	151.2890	151.2649	151.2594	151.2728	151.3069
151	153.2893	153.2652	153.2596	153.2730	153.3071
153	155.2897	155.2654	155.2598	155.2732	155.3073
155	157.2900	157.2657	157.2600	157.2733	157.3074
157	159.2903	159.2659	159.2602	159.2735	159.3076
159	161.2906	161.2661	161.2604	161.2736	161.3077
161	163.2909	163.2663	163.2606	163.2738	163.3078
163	165.2912	165.2665	165.2608	165.2740	165.3080
165	167.2915	167.2668	167.2610	167.2741	167.3081
167	169.2917	169.2670	169.2611	169.2743	169.3083
169	171.2920	171.2672	171.2613	171.2744	171.3084
171	173.2922	173.2674	173.2615	173.2746	173.3085
181	183.2936	183.2684	183.2623	183.2752	183.3091
191	193.2947	193.2692	193.2630	193.2758	193.3097
201	203.2957	203.2700	203.2636	203.2764	203.3101
301	303.3022	303.2749	303.2678	303.2798	303.3132
401	403.3056	403.2774	403.2699	403.2815	403.3147
501	503.3076	503.2789	503.2711	503.2825	503.3156
∞	(N+2).3159	(N+2).2849	(N+2).2762	(N+2).2866	(N+2).3194

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of external spur gears over wires.

MACHINERY'S Data Sheet No. 578, January, 1947 Compiled by The Van Keuren Co. Boston, Mass.

14000 Gear Ratios

With Examples Showing Use of Tables



This book contains about 400 pages of tabulated gear ratios and examples—14000 two-gear, and millions of possible four-gear combinations. The tables are presented in both common fractional and decimal forms and are divided into four main sections. These sections are arranged differently to facilitate solving, by simple direct methods, any type of gear ratio problem likely to arise.

SECTION 1—Common Fractional Ratios and Decimal Equivalents.

SECTION 2—Decimal Ratios, Logs and Equivalent Pairs of Gears.

SECTION 3—Total Number of Teeth with Equivalent Gear Pairs and Ratios.

SECTION 4—Numbers and Equivalent Gear Factors.

Book is 8-1/2 x 11 Inches. Price, $5 copy

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified

Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

News of the Industry

California

CLEVELAND TAPPING MACHINE CO., Cleveland, Ohio, manufacturer of vertical and horizontal high-speed tapping and drilling machines, has appointed the BURGAN MACHINERY CO., 9527 Fifth Ave., Inglewood, Calif., sales representative of the company in the states of California, Nevada and Arizona.

REED-PRENTICE CORPORATION, Worcester 4, Mass., announces that its sales and service facilities of the West Coast are now located at 2328 S. Santa Fé Ave., Los Angeles 11, Calif. JOHN G. THOMPSON is manager of this branch.

Illinois

SHAKEPROOF, INC., DIVISION OF ILLINOIS TOOL WORKS, Chicago, Ill., announces the following changes in personnel: EUGENE W. FULLER, previously sales manager, has been made manager for the entire division; B. F. BALES, formerly assistant sales manager, has been promoted to the position of sales manager; and RUSSELL H. MAUDE becomes sales manager of the Detroit district, while JOHN B. O'CONNOR, who previously held this position, has been made chief engineer.

L. B. PERKINS has been made assistant manager of the D. A. Stuart Oil Co., Chicago, Ill., manufacturer of cutting fluids and lubricants. He was previously secretary-treasurer. F. J. SCHMITT, formerly sales manager, has been promoted to the post of director of sales, and will be succeeded by C. N. COX as sales manager. J. E. MCCOY, who has been serving as assistant to the sales manager, becomes assistant to the director of sales.

PAUL A. THOMPSON, formerly of the research department of Sapphire Products Division, Elgin National Watch Co., Aurora, Ill., is the 1946 winner of the undergraduate student award presented annually by the American Society of Mechanical Engineers. Mr. Thompson, a junior student in mechanical engineering at the Illinois Institute of Technology, was given the award for his paper on "Synthetic Sapphire, a New Industrial Engineering Material."

CRUCIBLE STEEL CO. OF AMERICA announces the opening of a new steel warehouse at 4501-4531 W. Cortland St., Chicago, Ill. The sales force is supported by service engineers who are available for solving the intricate tool steel problems of the trade. This is the third expansion of the company's Chicago branch.

L. A. LINDBERG, president of the Lindberg Steel Treating Co., Chicago, Ill., was elected president of the Metal Treating Institute at its recent annual meeting in Atlantic City. The other officers elected were: R. G. SAULT, vice-president; R. W. THORNE, treasurer; STEWART N. CLARKSON, executive secretary; and J. R. MACALLISTER, assistant secretary.

INDEPENDENT PNEUMATIC TOOL CO., Chicago, Ill., manufacturer of Thor portable pneumatic and electric tools, announces a $1,000,000 expansion of its main works at Aurora. The new construction will provide 85,000 square feet of additional floor space for production purposes.

HARRY A. DENNIS has been made assistant district manager of sales in the Chicago office of the Lukens Steel Co. and subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa.

WILKINSON EQUIPMENT CO., 109 E. 69th St., Chicago 37, Ill., has recently been appointed sales distributor for RB abrading pads, designed for internal and external finishing, cleaning or polishing, deburring, chamfering, etc.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., has reopened its branch office in Chicago at 120 S. La Salle St., with HARRY TEMPORAL in charge.

Michigan

VICTOR S. RYKWALDER, of the University of Detroit, has been named recipient of the Charles T. Main Award for 1946, presented by the American Society of Mechanical Engineers. The award is made to students in the mechanical engineering and aeronautical engineering departments of accredited engineering colleges in the United States and Canada, and consists of a cash prize of $150 and a trip to the annual meeting of the Society in New York. Mr. Rykwalder's award was given for his paper on "Creative Engineering as a Factor in Promoting Full Employment."

GEAR GRINDING MACHINE CO., Detroit, Mich., announces that a new company has been organized to manufacture the Formsprag over-running clutches and Ballflex flexible couplings. The increasing demand for these products has made it necessary to organize a new company that will devote its entire efforts to the design, development, and production of these products. The new concern is known as the FORMSPRAG CO., and is located at 1415 Jarvis St., Ferndale, Mich.

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich., announces the formation of a process engineering department which will provide engineering service in cases where resistance welding is being considered as a means of fabrication. RAY A. OBRECHT will have charge of the new department.

TOMKINS-JOHNSON CO., Jackson, Mich., manufacturer of air and hydraulic cylinders, riveters, die-sinking milling cutters, and air controls, announces the appointment of the following representatives: C. E. HAMILTON, 1411 Fourth Ave. Bldg., Seattle, Wash., and A. B. ANDREWS, JR., Insurance Bldg., Raleigh, N. C.

LLOYD L. LEE, formerly vice-president in charge of sales and engineering with the Plan-O-Mill Corporation, Hazel Park, Mich., has become associated with Frederick Colman & Sons, Inc., in the Machine Tool Division of the company at Detroit, Mich.

D & S MODEL CO. has moved from Dayton, Ohio, to 105-21 S. Robert St., Ludington, Mich. The company manufactures a line of surface grinder attachments and small tools, and is also engaged in custom tool and die work.

GERHARDT BARTZ has been made works manager of the Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit 7, Mich. He was formerly assistant plant engineer for the Dodge Forge Division of the Chrysler Corporation.

W. E. GILBERT has been appointed manager of the Processing Equipment Division of the Detrex Corporation, 14331 Woodrow Wilson Ave., Detroit, Mich., manufacturer of solvent degreasers, metal-parts washers, and similar equipment.

ROBERT L. CRINNIAN has been named assistant chief engineer of the Pioneer Engineering & Mfg. Co., Detroit, Mich., and GORTON M. EVANS, purchasing agent.

Paul W. Polk, Newly Appointed Vice-president and Manager of Threadwell Tap & Die Co.

New England

PAUL W. POLK has been appointed vice-president and manager of the Threadwell Tap & Die Co., Greenfield, Mass. For several years Mr. Polk has been vice-president of the Sheffield Corporation, which recently acquired the Threadwell Tap & Die Co. The latter company will continue to be operated as an independent subsidiary. Although continuing to serve as a director and officer of the Sheffield Corporation, Mr. Polk will devote all his time to his new responsibilities at Greenfield.

ROLLED THREAD DIE CO. and REED SMALL TOOL WORKS, of Worcester, Mass., have been consolidated under the name of the REED ROLLED THREAD DIE CO. The location of the plants remains the same—237 Chandler St., Worcester 2, Mass.—and the ownership, policies, and personnel will not be affected. The company will specialize in thread and form rolling tools and equipment.

GEORGE H. POWERS has been appointed boron carbide engineer by the Norton Co., Worcester, Mass. He will handle the sale and application of Norbide products in the New England territory, as well as in New York, Philadelphia, Pittsburgh, and upper New York State. His headquarters will be at Worcester.

DU MONT CORPORATION, Greenfield, Mass., announces that it is now manufacturing a complete line of keyway cutters and keyway cutter sets for cutting standard-width keyways in gears, pulley hubs, couplings, milling cutters, collars, and other parts.

NILES-BEMENT-POND CO., West Hartford, Conn., announces that the company's wholly owned subsidiary—the CHANDLER-EVANS CORPORATION — has been merged with the parent company, and will be known in the future as the CHANDLER-EVANS DIVISION OF NILES-BEMENT-POND CO. This change will not affect the operation of the business. B. H. GILPIN, vice-president and general manager of the Chandler-Evans Corporation, will become vice-president of Niles-Bement-Pond Co., and will continue as general manager of the Chandler-Evans Division. M. E. CHANDLER, now vice-president in charge of engineering, will become manager of engineering and research for the Division.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed SILLITER-HOLDEN, INC., 433 New Park Ave., Hartford 1, Conn., distributor for cemented-carbide tipped tools in Hartford and the north central Connecticut area.

New York and New Jersey

W. C. YATES, assistant manager of the Industrial Divisions of the General Electric Co., Schenectady, N. Y., has retired after forty-eight years of service with the company. Mr. Yates was affiliated for thirty years with the control section activities of the National Electric Manufacturers Association. A dinner in his honor was given in recognition of these activities, as well as of his long service with General Electric.

MARCUS A. COOLIDGE for forty years head of the Seneca Falls Machine Co., Seneca Falls, N. Y., has resigned as president and has been elected chairman of the board of directors. He is succeeded as president by EDWIN R. SMITH, for many years executive vice-president and treasurer. Mr. Smith will also retain the office of treasurer.

H. M. DAWSON has been appointed managing director of the Jessop Steel International Corporation (formerly the Jessop Export Sales Corporation), subsidiary of the Jessop Steel Co., Washington, Pa. Mr. Dawson's headquarters are in the Evening Post Building, 75 West St., New York City.

C. E. HERINGTON has been appointed manager of the sales engineering department of the Meehanite Metal Corporation, New Rochelle, N. Y. He has been director of advertising and sales promotion, and will continue to carry out these duties, in addition to directing the new department.

CARL F. DIETZ, president of the Lamson Corporation, Syracuse, N. Y., manufacturer of pneumatic and mechanical conveyor equipment, has been elected president of the Manufacturers Association of Syracuse for the year 1946-1947.

R. F. HILBERT has been appointed sales agent in the Rochester, N. Y., area for the Vascoloy-Ramet Corporation, North Chicago, Ill., manufacturer of cemented-carbide and cast-alloy cutting tools.

RAY H. MORRIS has resigned his position with Hardinge Brothers, Inc., Elmira, N. Y., in order to take a rest. He has not yet announced any plans for the future.

KELLY REAMER CO., Cleveland 1, Ohio, has appointed the O. A. MUENZ CO. exclusive sales and engineering representative for the company in lower New York State, northern New Jersey, and Fairfield County, Connecticut. The O. A. Muenz Co. maintains offices at 239 Bloomfield Ave., Bloomfield, N. J., and 932 E. Main St., Bridgeport, Conn.

VAN RIPER ENGINEERING, INC., 4 Station Square, Rutherford, N. J., has recently been organized to provide consulting engineering service on hydraulics, electronics, gearing, production methods, and general product and machine design.

Ohio

TOOL-DIE ENGINEERING CO., 1720 Euclid Ave., Cleveland 15, Ohio, announces the opening of a plant at E. 93rd St. and Loren Ave., Cleveland, for the manufacture of zinc and aluminum die-castings, as well as permanent-mold castings. During the war, the company was engaged in engineering work, especially in designing and building of die-casting dies. The president of the company is C. G. SIEFERT, formerly manager of the Die-Casting Division of the Cleveland Hardware & Forging Co. J. J. SCHMADER is vice-president and chief engineer. In addition to producing die-castings, the company will continue to do consultant and contract work.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the following changes in personnel: SOL EINSTEIN, vice-president, and DR. OTTO P. GEIER, director of the employes' service department, have retired after having been associated with the company for forty-three and thirty-three years, respectively. Mr. Einstein became chief engineer in 1920, and was made vice-president and a director in 1936. Dr. Geier brought his doctor's office into the Cincinnati Milling Machine Co.'s plant in 1913 and has been an im-

Because They Are More Than

TWICE AS RIGID

These Grooving Tool Blades Are

TWENTY TIMES AS PRODUCTIVE

Weaving—major cause of excessive wear in slender grooving tool blades—can now be overcome by using sturdy, hard blades of solid Kennametal. Here's one example—

In a large automobile plant, solid Kennametal blades are now cutting piston ring grooves in 18,000 to 20,000 aluminum alloy pistons before resharpening, whereas the previously-used carbide-tipped steel-shank tools had to be serviced after cutting grooves in 800 pistons.

These new solid Kennametal blades cut better, longer, not simply because they are much *harder* than steel, *but primarily because their resistance to deflection is two to three times* as great as steel. Weaving that causes erratic cutting pressures, strains, and rapid cutting edge failure is thereby minimized.

Kennametal grooving tool blades are made in standard widths from .080" to .250". Other sizes are available. Ask our nearest representative, or write for prices and particulars.

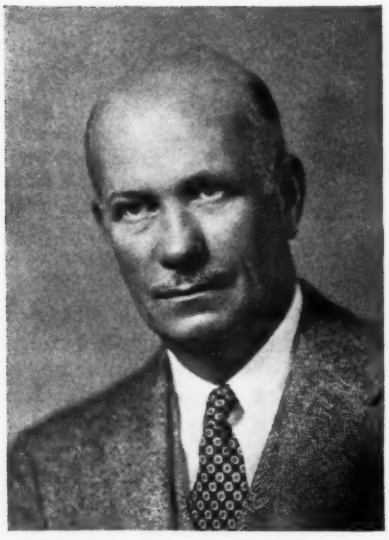
KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL *Inc.*, LATROBE, PA.

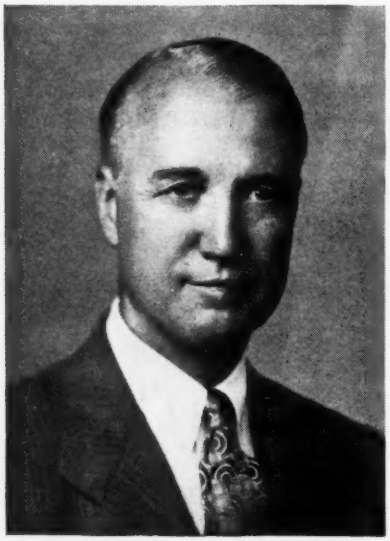
(Left) Sol Einstein, Who has Retired as Vice-president of the Cincinnati Milling Machine Co. (Center) Dr. Otto P. Geier, Director of Employes' Service Department, Who has also Retired. (Right) Lincoln Mehlhope, Successor to Mr. Einstein



Philip H. Cone, New Director Employes' Service Department

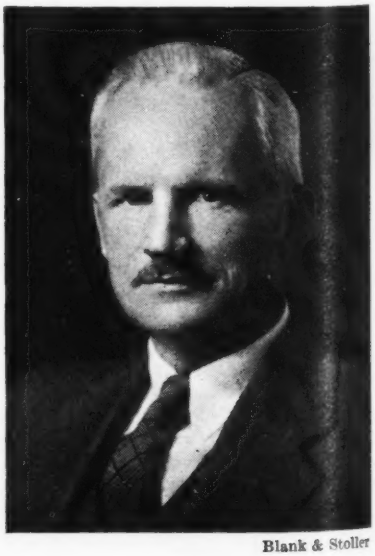
portant factor in the spread of industrial medicine throughout the country. He has been an officer and a director of the company for the last thirty years. LINCOLN MEHLHOPE succeeds Mr. Einstein, while PHILIP H. CONE will take over Dr. Geier's activities, with Dr. Geier continuing to serve as consultant. Mr. Mehlhope, who is an engineering graduate of the University of Cincinnati, has been associated with the company since 1924. CARL F. ROBY has been appointed assistant to WALTER W. TANGEMAN, vice-president and general manager. Mr. Roby has been with the company since 1916, except for a brief period during World War I, when he was in military service. He was made works manager in 1929, and five years later was sent to Birmingham, England, in the capacity of managing director of Cincinnati Milling Machines, Ltd. FERRIS M. ANGEVIN, previously secretary of the company, has become treasurer, and is succeeded as secretary by MILLARD ROMAINE, who held the post of general sales manager from 1938 to 1941.

Carl F. Roby, Assistant to Vice-president and General Manager



ELMER ANDERSON, formerly service engineer in the Milwaukee office of the Timken Roller Bearing Co., has been appointed assistant service manager, with headquarters at the main office in Canton, Ohio. LELAND S. STEINER, assistant superintendent of maintenance for the Timken Steel and Tube Division, has been elected

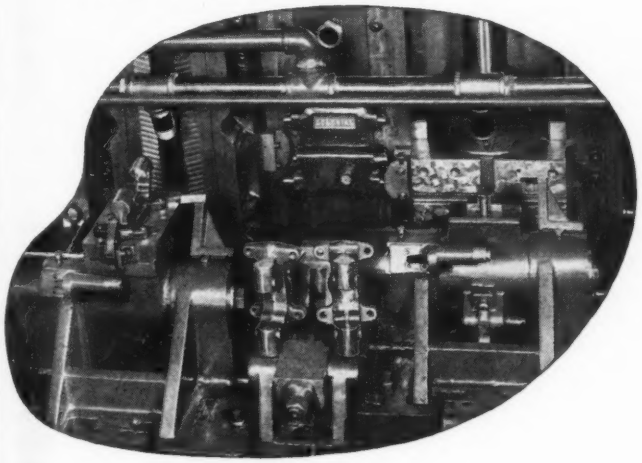
(Left) Millard Romaine, Recently Appointed Secretary of Cincinnati Milling Machine Co. (Right) Ferris M. Angevin, Newly Appointed Treasurer of the Company



Blank & Stoller

INCREASE YOUR LABOR-PRODUCTIVITY by broaching ----- WITH Colonials

Typical and fairly average example of metal removal possible by broaching. Automotive steering knuckles—broached at rate of 360 pieces per hour on a Colonial Dual Ram machine . . . REMOVING 450 CU. IN. OF METAL AN HOUR!



Broaching offers one of the readiest answers to today's biggest manufacturing problem—how to increase the productivity of the individual worker to justify higher wages.

The reason of course is that broaching is the fastest method of metal removal known—and one of the most accurate. Moreover, though Colonial machines usually pay for themselves in short order, they do not become obsolete when models are changed.

With Colonial Broaching machines and broaches, and through Colonial's engineering service, you can obtain all the benefits of special purpose automatic machinery combined with the long life—for capital write-offs—of standardized machines.

Write us today for a study of how Colonials can increase your labor productivity. There is a Colonial field engineer near you.

colonial BROACH COMPANY
DETROIT 13, U.S.A.

Broaches — Broaching Machines - Broaching Equipment

a director of the Association of Iron and Steel Engineers for the year 1947.

LINCOLN ELECTRIC CO., Cleveland 1, Ohio, announces the appointment of the following new welding sales engineers: MARVIN ANDERSON, Moline, Ill.; ALBERT BAVARIA, Philadelphia, Pa.; RICHARD FREUNDLICH, Cleveland, Ohio; PAUL HOLDEN, Franklin, Pa.; RICHARD NELSON and JOHN E. WILLIAMS, Syracuse, N. Y.; and RICHARD K. REYNOLDS, Detroit, Mich.

R. B. TRIPP, formerly vice-president of the Ohio Forge & Machine Corporation, Cleveland 4, Ohio, has been advanced to the office of executive vice-president. T. E. LEIGHTON, secretary and treasurer, becomes vice-president and treasurer, and C. E. THAYER, assistant secretary, has been made secretary.

H. J. LEISENHEIMER has been appointed director of export sales of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, manufacturer of hydraulic machines for metal forming, forging, die-casting, plastics molding, and other pressure processing.

CARL R. SARE, vice-president of the Morrison Engineering Corporation, 5005 Euclid Ave., Cleveland 3, Ohio, manufacturer of industrial furnaces and ovens, has been elected president and a director of the corporation.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces the opening of a new warehouse for stocking tool steels at 1270 McCook Ave., Dayton, Ohio, designed to serve southwest Ohio and the state of Kentucky.

ALBERT C. WALSH, purchasing agent for the Timken Roller Bearing Co., Canton, Ohio, has retired after twenty-six years of service with the company.

Pennsylvania

JOHN G. FRITZINGER has been appointed district sales manager of the Philadelphia sales office of the Carborundum Co., Niagara Falls, N. Y. He has been a sales engineer for the Refractories Division of the company in the Philadelphia area since 1924. Mr. Fritzinger succeeds WILLIARD J. GRIFFITH, who has resigned to form an industrial supply company with PAUL E. RAGUSE, previously industrial salesman for the Carborundum Co. in the Philadelphia district. The principal business of the new company will be the distribution of Carborundum products in the Philadelphia metropolitan area.

KENNAMETAL INC., Latrobe, Pa., has added the following men to its staff of application engineers: DELMAR E. BAKER, with headquarters at 9 N. Jefferson St., Chicago, Ill.; WILLIAM L. CHAMBERS and RICHARD H. OBERHOLTZER, 5531 Woodward Ave., Detroit, Mich.; and LEO J. PERRETTE, 2162 Gilbert Ave., Cincinnati, Ohio. The company also announces the appointment of the following representatives: ROBERT S. SAGERS, in the Middle Atlantic district, with headquarters at 3701 N. Broad St., Philadelphia, Pa.; and ALLEN M. AUSTIN in the Kansas City area, with headquarters at 9 N. Jefferson St., Chicago, Ill.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has recently completed a new office building at its Pittsburgh steel-service plant. The new two-story building, which adjoins the warehouse, has been designed especially to provide working space that will assure maximum speed and efficiency in handling orders.

J. F. SIMON, JR., has been appointed works manager of the Paul and Beekman Division of Portable Products Corporation, Philadelphia, Pa., manufacturer of stamped and drawn metal parts. For the last two years, Mr. Simon has been plant manager of the Roller-Smith Co., Bethlehem, Pa.

REEVES PULLEY CO., Columbus, Ind., manufacturer of variable-speed control units, announces the opening of an office at Wilford Bldg., 33rd and Arch Sts., Philadelphia 4, Pa. PHILIP C. TALBOT will be manager of the new branch office, assisted by WILLIAM A. MCCOSH.

LEE G. MILLER has been appointed plant manager in charge of all operations of the Lebanon Steel Foundry, Lebanon, Pa. He was formerly superintendent, and takes the place of FRANK J. STANLEY, who has resigned. Mr. Miller has been connected with the company for twenty years.

H. K. PORTER CO., INC., Pittsburgh 22, Pa., announces that it has moved its two Quimby pump manufacturing plants located at Newark and New Brunswick, N. J., to the company's plant at 49th and Harrison Sts., Lawrenceville (Pittsburgh), Pa.

LEES-BRADNER CO., Cleveland 11, Ohio, announces the appointment of LLOYD & ARMS, 133 S. 36th St., Philadelphia 4, Pa., as distributor for the gear hobbers, gear grinders, and gear testers made by the company.

FRANCIS B. NIMICK was elected a director of the Vanadium-Alloys Steel Co., Latrobe, Pa., at a recent meeting of the board of directors to fill the vacancy created by the death of T. H. Childs.

JOHN L. LANG has joined the staff of Lukenweld Inc., a division of the Luken Steel Co., Coatesville, Pa., in the capacity of welding engineer.

Virginia, Georgia, and Maryland

ARCHIBALD E. SMITH has established a business as engineering consultant at 205 N. Noland St., Falls Church, Va. He will specialize in problems of interchangeable manufacturing, screw thread design, etc. Mr. Smith was connected continuously for more than twenty-nine years with the gage section of the Army Ordnance Department.

LEBANON STEEL FOUNDRY, Lebanon, Pa., announces the opening of a new sales engineering office in Atlanta, Ga., at 17 Edgewood Ave., N.E. JOHN H. BOYD will have charge of the new office. He has been with the company since his release from the Army, formerly having been connected with the engineering sales department at Lebanon.

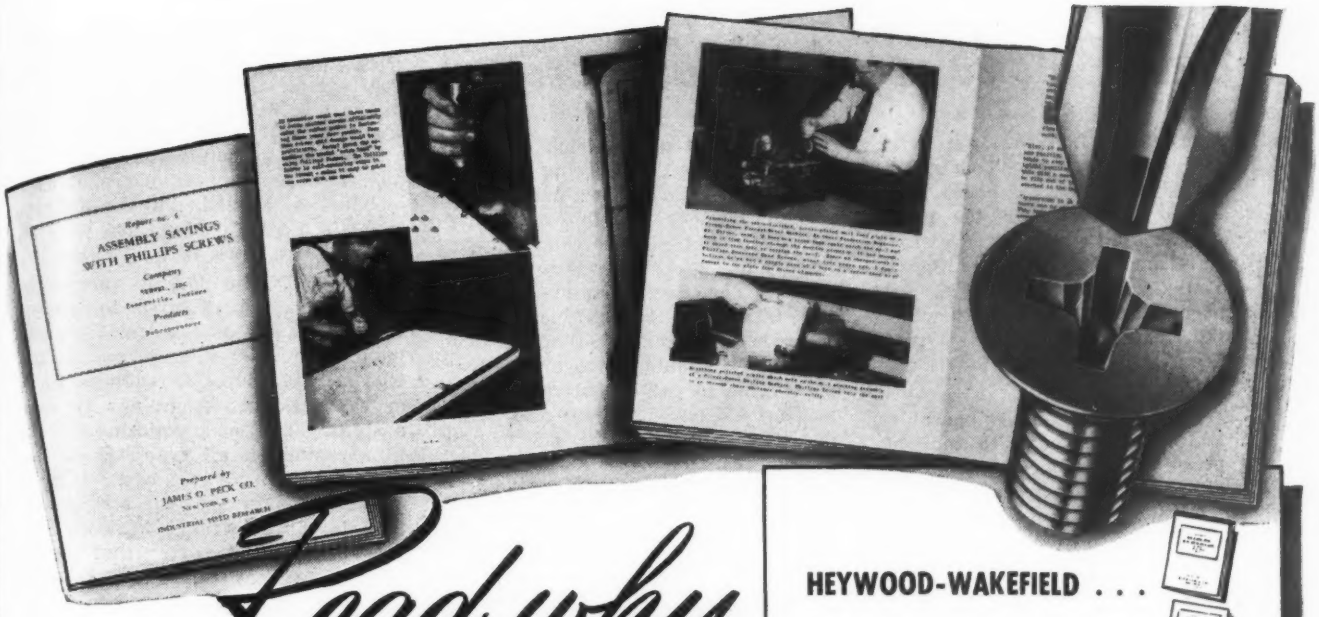
KENNAMETAL INC., Latrobe, Pa., has established an office at Room 1605 Court Square Bldg., Baltimore, Md., with HARRY W. BEARFOOT as representative.

Wisconsin

L. H. BILLINGS has been appointed district manager of a newly created sales territory for the Falk Corporation, Milwaukee, Wis. The new territory will comprise Wisconsin, upper Michigan, and parts of Iowa. Mr. Billings was previously production manager, and has been connected with the company for twenty years. B. C. BUGBEE has been named production control manager of the corporation. He was formerly assistant to the works manager.

LINK-BELT CO., Chicago, Ill., manufacturer of materials-handling and mechanical power transmission machinery, announces the opening of a sales office in the Century Building, 808 N. Third St., Milwaukee, Wis. WILLIAM M. HUFNAGEL, district sales manager, is in charge of the new office, assisted by H. B. JOHNSON and F. E. SWEENEY.

OSCAR FROHMAN has been appointed general sales engineer for Ampco Metal, Inc., Milwaukee 4, Wis. He previously served as manager of market development for the company. JAMES ARTER, who was formerly general sales engineer, has been assigned the duties of assistant to the general manager.



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New Books and Publications

PRECISION HOLE LOCATION FOR INTERCHANGEABILITY IN TOOLMAKING AND PRODUCTION. 448 pages, 6 3/4 by 10 inches; over 400 photographs and working drawings. Published by the Moore Special Tool Co., Bridgeport, Conn. Sold at a special price of $3 within the metal-working industry in the United States, $3.50 elsewhere.

Jig borer and jig grinder operators, and others concerned with toolmaking practice, will find this contribution to the literature on precision-hole location of unusual interest. The book is a comprehensive review of all hole-location practices and their evolution to the point where the toolmaker can now employ engineered methods and apply the principle of interchangeability to his own operations. The first chapters of the book review the laborious time-consuming hole-location methods used prior to the development of modern hole-location equipment, as exemplified in the present designs of jig boring and grinding machines. Comparisons are made between the old methods and new methods on actual jobs. The chapter entitled "Jig Boring Practices," which contains over 100 photographs and drawings, presents instructional and operational short-cuts dealing with a whole range of tools and dies, and gives time estimates on a variety of jobs. Another extensive chapter, "Hole Grinding in Jig Time," describes in detail the modern methods for finish-grinding holes in hardened parts. The concluding chapter "Now Interchangeability in Toolmaking" shows the toolmaker how to get the most out of modern location (jig boring and jig grinding) machines. An outstanding feature of the book consists of 184 pages of Woodworth hole-location tables for converting holes on circles to rectangular coordinates—not available elsewhere.

JOB EVALUATION. By Forrest H. Johnson, Robert W. Boise, Jr., and Dudley Pratt. 288 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 400 Fourth Ave., New York 16, N. Y. Price, $3.75.

The recent large increase in the number of industrial job-evaluation programs has created the need for a text-book to explain how such plans function under actual operating conditions. This book has been written to satisfy that need. The purpose is not to specify a ready-made job-evaluation plan, but to show how a typical plan works out in practice. The first part of the book describes the principles underlying the organization of a job-evaluation plan and department, and following chapters describe typical factory and clerical and technical job-evaluation plans. The final chapter discusses the trends in job evaluation and what is to be expected of it. The data given should prove of considerable value to the executive in interpreting job classifications and in organizing a systematized but flexible pay-rate control.

A.S.M.E. MECHANICAL CATALOG AND DIRECTORY (1947). 792 pages, 8 1/2 by 11 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

The thirty-sixth annual edition of this collective catalogue and directory of industrial equipment and supplies covers the products of nearly 5000 firms under approximately 50,000 product listings. The form of the book is the same as in previous editions and consists of three principal parts: The first section contains catalogue data covering hundreds of items used by industry in manufacturing its products and maintaining its plants; the second section, or directory, contains a list of mechanical equipment, machinery and supplies, together with the manufacturers' names and addresses, classified by product; the third section consists of an alphabetical list of trade names supplied by the publications of the firms listed. The material is indexed and cross-indexed to facilitate reference.

FINISHING METAL PRODUCTS. By Herbert R. Simonds and Adolph Bregman. 352 pages, 5 1/4 by 8 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.

The rapid progress in plastics and synthetic resins during the war years has been reflected in the development of coatings with new and surprising properties. In the second edition of this book treating of the finishing of metal products, many developments in the metal-finishing field that took place during the war and the years immediately preceding are described. The technique involved in metal finishing is discussed, including such processes as cleaning and descaling, and the commercial aspects are covered. The book also describes the equipment involved and the design of parts that require finishing, etc. The new material in this edition includes chapters on coloring metal, costs and estimates, and organic coatings.

PLASTICS HANDBOOK FOR PRODUCT ENGINEERS. Compiled and edited by John Sasso. 468 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.

The basic aim of this volume, as stated in the preface, is to present in concise handbook form fundamental data of specific use to the engineer planning to adopt plastics or synthetic rubber in new product designs. The book contains specific information on all types of plastics and the properties of each; how to select the right type for a given application; processing, machining, and finishing plastic parts; and design details, such as tolerances, threads, fastening, etc. The common faults found in molded plastic parts, and their causes and remedies, are also discussed. Synthetic rubbers are also covered.

RADIANT HEATING. By T. Napier Adlam. 472 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $6.

This is a comprehensive treatise on the subject of radiant or panel heating as applied in the building construction field. It gives complete information on the design, installation, and control of hot-water, steam, warm-air, and electric radiant heating systems for industrial and other buildings, written by a man who is an outstanding authority on the subject. Engineers, contractors, architects, and others interested in this application of radiant heating will find this book a valuable working manual.

* * *

Charts for Calculating Wire Measurement of Gears

The Van Keuren Co., 176 Waltham St., Watertown, Mass., has published a series of printed forms for making calculations of measurements over wires for spur and helical gears. These are identified as follows: VK-101, "Wire Measurement of Standard Spur Gears"; VK-102, "Wire Measurement of Spur Gears—Enlarged Pinions and Reduced Gears"; VK-103, "Wire Measurement of Standard Helical Gears"; VK-104, "Zahorski Method for Measuring Standard Helical Gears"; VK-105, "Zahorski Method for Measuring Enlarged or Reduced Helical Gears."

These bulletins are available at 5 cents per sheet. They can also be obtained in pads of twenty-five for each separate form.

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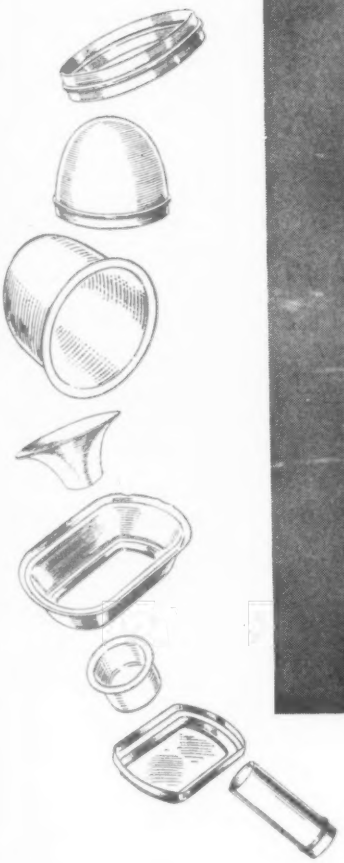

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Coming Events

JANUARY 14-17—NATIONAL MATERIALS-HANDLING EXPOSITION at the Public Auditorium, Cleveland, Ohio. Chairman of exposition committee, Edwin J. Heimer, president of Barrett-Cravens Co., Chicago, Ill.

JANUARY 23-26—Second conference and exhibit of the LOW-PRESSURE DIVISION OF THE SOCIETY OF THE PLASTICS INDUSTRY, INC., at the Edgewater Beach Hotel, Chicago, Ill. For further information, address the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y.

FEBRUARY 4-7—MAGNESIUM EXHIBIT at Wright Field, Dayton, Ohio, under the auspices of the United States Army Air Forces and the Magnesium Association. Further information can be obtained from T. W. Atkins, executive vice-president of the Magnesium Association, 30 Rockefeller Plaza, New York City.

FEBRUARY 24-28—Spring meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Benjamin Franklin Hotel, Philadelphia, Pa. Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

MARCH 17-19—CHICAGO PRODUCTION SHOW AND CONFERENCE in the Exhibition Hall of the Stevens Hotel, Chicago, Ill., under the auspices of the Chicago Technical Societies Council, 53 W. Jackson Blvd., Chicago 4, Ill.

MARCH 22-28—FIFTH WESTERN METAL CONGRESS AND EXPOSITION in Oakland, Calif., sponsored by the American Society for Metals. Managing Director of the Exposition, W. H. Eisenman, Hotel Leamington, Oakland, Calif.

MARCH 25-28—SEVENTEENTH ANNUAL SAFETY CONVENTION AND EXPOSITION in New York City, sponsored by the Greater New York Safety Council, 60 E. 42nd St., New York 17, N. Y. Headquarters, Hotel Pennsylvania.

APRIL 29-MAY 1—INDUSTRIAL PACKAGING AND MATERIALS-HANDLING EXPOSITION at Hotel Sherman, Chicago, Ill., sponsored by the Industrial Packaging Engineers' Association of America, 134 S. La Salle St., Chicago 3 Ill.

MAY 5-11—NATIONAL PLASTICS EXPOSITION at the Coliseum, Chicago, Ill., under the auspices of the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y.

JUNE 16-20—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, C. L. Warwick, 1916 Race St., Philadelphia, Pa.

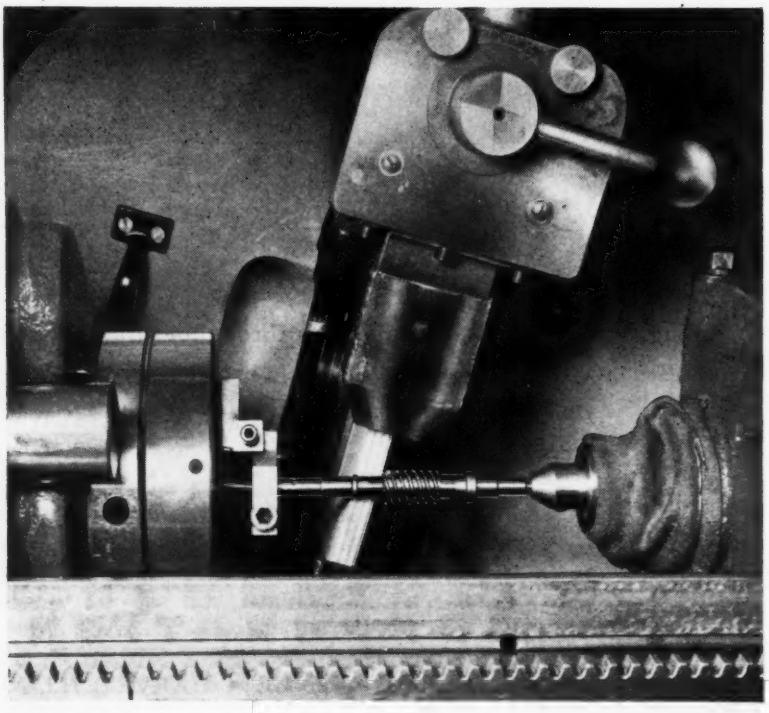
* * *

The so-called wastes of competition are the price we pay for freedom, and by freedom we become so productive that we can afford to pay the price.—*Donald R. Richberg*

Obituaries

WILLIAM WERME, general superintendent of the Worcester Pressed Steel Co., Worcester, Mass., died on November 30 at his home in Worcester, aged sixty-five years. Mr. Werme was born in Charlottenberg, Sweden, and came to this country in 1889. His first job was with the Reed-Prentice Corporation, from which he went to the Heald Machine Co., where he became foreman machinist. In 1905, he went with the Worcester Pressed Steel Co., and five years later was elected a director of the company. He was made assistant superintendent in 1912, shortly after becoming general superintendent. Mr. Werme was a director of the Guaranty Bank and Trust Co. of Worcester, and a founder and incorporator of the Fairlawn Hospital. His outstanding mechanical ability and pioneer work in metal forming, combined with his simple friendly approach, made him known throughout the stamping industry.

DAVID FITZGERALD, manager of employe relations for the Plastics Divisions of the General Electric Co., Pittsfield, Mass., died at his home in Pittsfield on November 28, after an illness of several months. Mr. FitzGerald had been associated with the company for twenty-five years. In 1940, he was named assistant to the manager of the Plastics Divisions, and in May of this year was made manger of employe relations.



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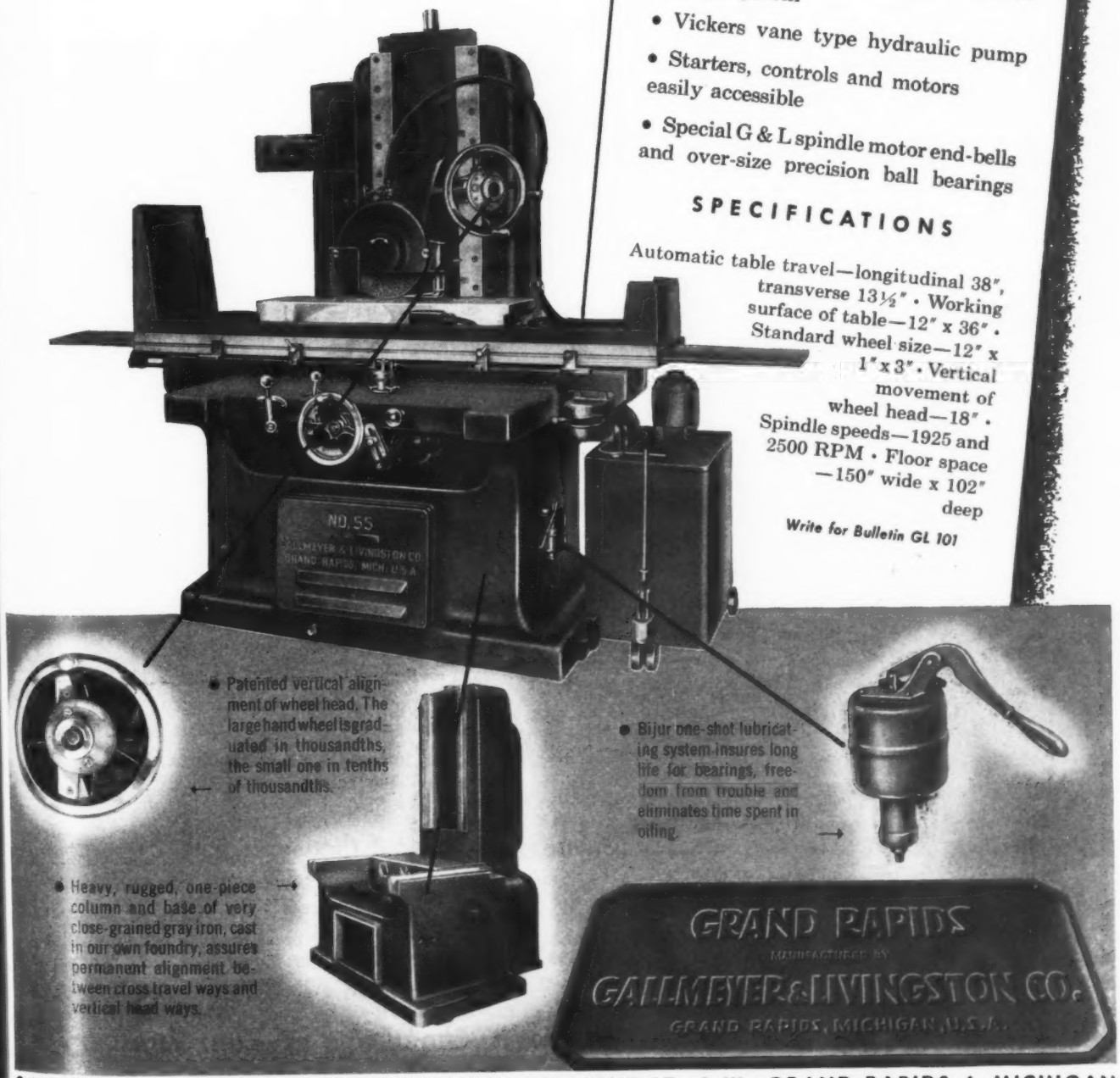
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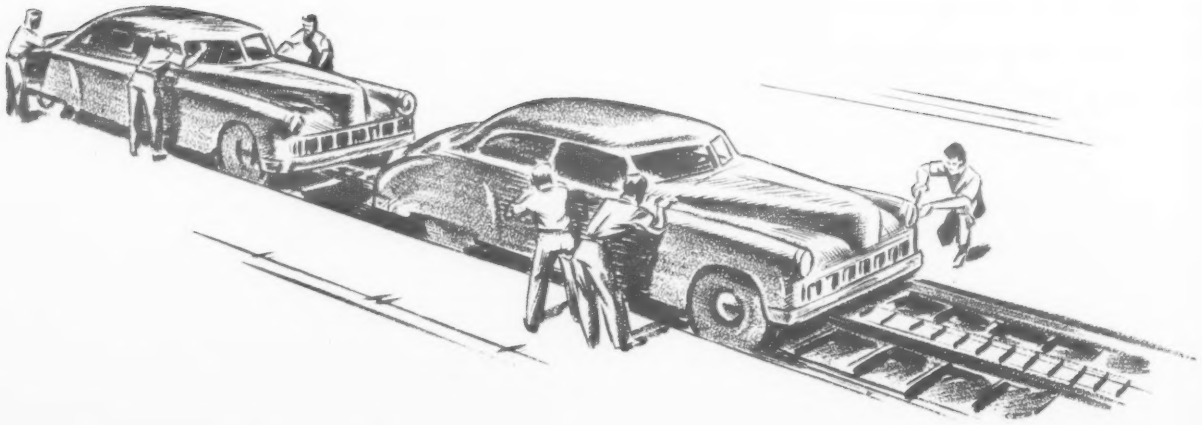

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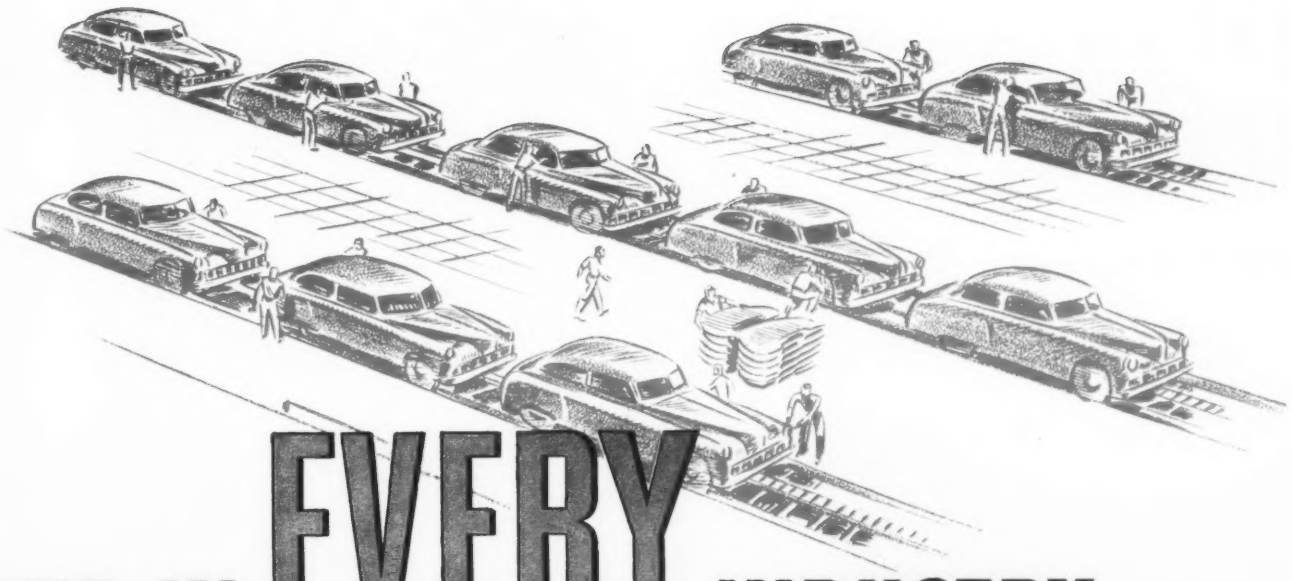

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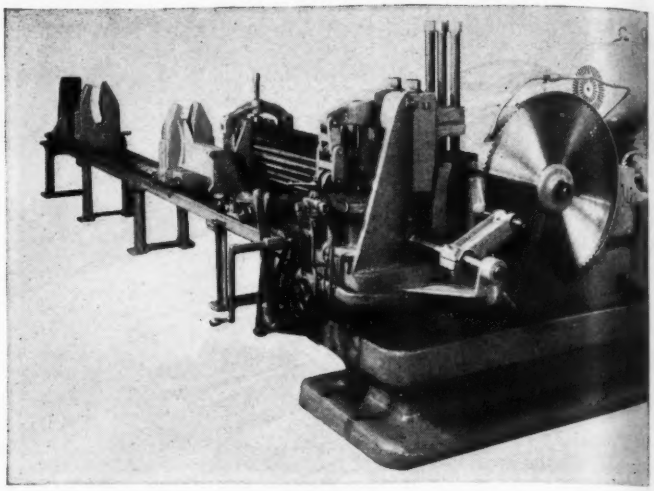
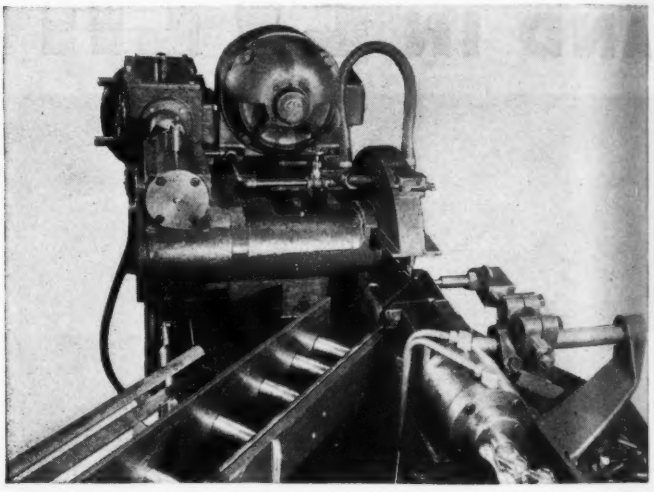


Far greater production, far closer tolerances, accuracy to the last cut on the bar — that was the result when Cochrane-Bly engineers designed special vise, truck shoes and stock pusher for this Cochrane-Bly saw. The shoes were made with a radius to conform to the radius of the blade to cut all pieces simultaneously. Simple? Easy? Sure! Just like your sawing problems will be to Cochrane-Bly engineers.



It took three machines and four operations to make the 45 degree angular cuts on 1 inch half round material for this company. Cochrane-Bly engineers, by designing special jaws and set-up for the No. 51 saw quadrupled production at approximately one fifth of the cost. Most likely you too can profit by a Cochrane-Bly analysis of your sawing problems.

YOU TELL US — AND WE'LL TELL YOU

What metals do you saw — ferrous, non-ferrous or both? What are the types, sizes and shapes to be cut? How much production do you want? What lengths do you cut from? What length pieces do you need? What about tolerances? All easy questions but maybe the answers are tough. The authoritative way to get them is to ask us. A half century of experience will go into the answers. Better ask them now.

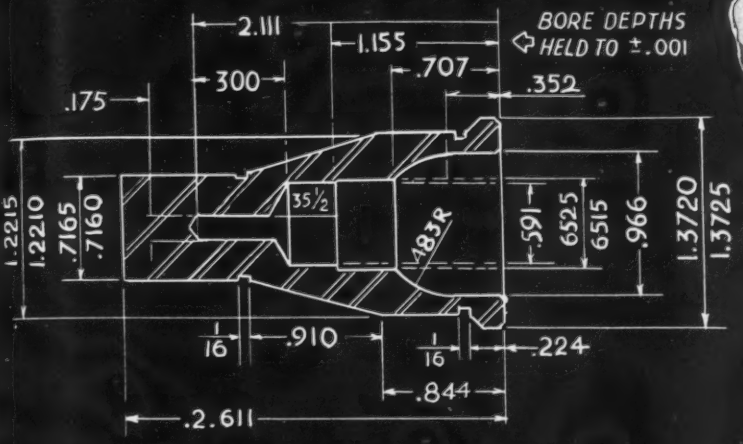
COCHRANE - BLY COMPANY

St. James Street **Rochester, New York**

COCHRANE-BLY COMPANY

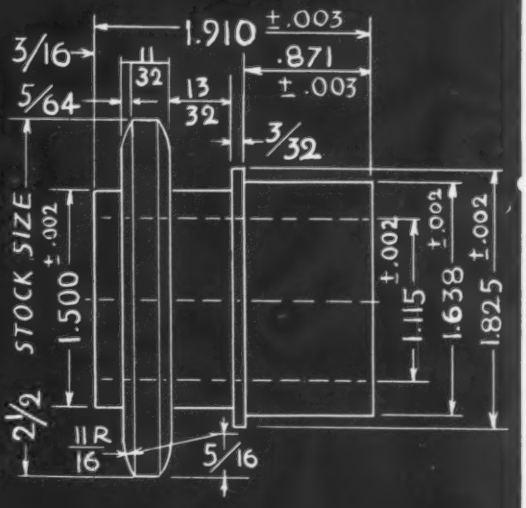
CYLINDER AIR CHAMBER

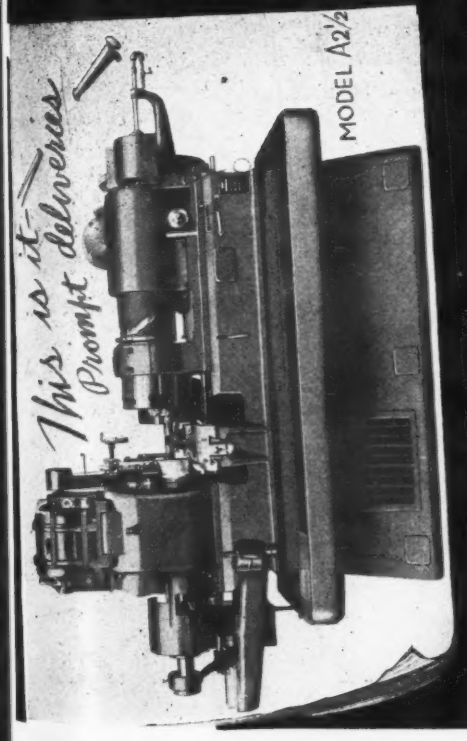
1. Gauge from rear slide Drill 7/8" dia. 1/2" deep at 352 R.P.M.
2. Drill 37/64" dia. 1.456" deep. Form outside dia. complete and face at 316 R.P.M.
3. Drill 11/64" dia. 2.112" deep at 1502 R.P.M.
4. Counterbore .956" and .642" dias., and Skive outside dia. after counterbore at 316 R.P.M.
5. Finish ream all diameters. Cut off at 352 R.P.M.



TRANSMISSION SPROCKET

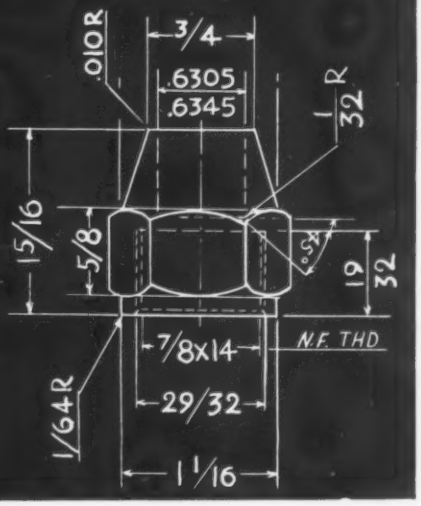
1. Gauge. 2. Spot for drill at 395 R.P.M.
3. Drill 1 3/32" dia. hole. Face end, form 1.638" dia. and 1.825" dia. with front slide. Form 1.500" dias., both faces of tooth form and breakdown for cutoff to 1.500" dia. with rear slide at 231 R.P.M.
4. Ream hole to 1.115" dia. at 395 R.P.M.
5. Cutoff with independent cutoff attachment at 395 R.P.M.





COUPLING

1. Gauge.
2. Drill for tap (use .807 dia. drill with 45° point) at 1010 R.P.M.
3. Drill rest of way through with 39/64 drill at 1010 R.P.M.
4. Tap 7/8—14 pitch thread at 198 R.P.M.
5. C'Bore .630 dia. and chamfer I.D. on front of piece. Cutoff on return stroke at 1010 R.P.M.



Joe, Please NOTE! a Cleveland Automatic ("Model A2½") cuts costs on Jobs like these

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 BEECH STREET • • CINCINNATI 12, OHIO

CHICAGO (6) 1408B Civic Opera Bldg. CLEVELAND (3) 2269B Ashland Rd. DETROIT (2) 540B New Center Bldg.
HARTFORD (1) 529B Capital National Bank Bldg. NEW YORK (6) 2402B Singer Bldg.

Get the Facts..

on the NEW Motch & Merryweather No. 00 CIRCULAR SAWING MACHINE

FOR THE SAWING OF METAL
1/4" TO 2" DIAMETER

Triple-Chip METHOD

No. 00 AUTOMATIC COLD SAW

You can now enjoy the proven superiority of the Motch & Merryweather Triple-Chip Method in the circular cold sawing of metal, ferrous and non-ferrous, up to 2" diameter. The new No. 00 Automatic pictured here has the fundamental advantages of the larger Motch & Merryweather machines, together with important new features. You get speed, smooth cuts and freedom from burrs that often eliminate secondary operations, solidity and rigidity which mean long life and continuous profit-making. In many cases you can eliminate milling cut-off operations. Four models to meet every requirement:

AUTOMATIC • SEMI-AUTOMATIC • POWER FEED • MANUAL

Ask for your copy of our new, well illustrated 12-page Bulletin "M-1."

Only M&M builds ALL 3: COLD SAW SAW BLADE BLADE GRINDER

Also...

THE No. 2
Circular Sawing Machine for stock up to 6 inches

THE No. 3
Circular Sawing Machine for stock up to 10 inches

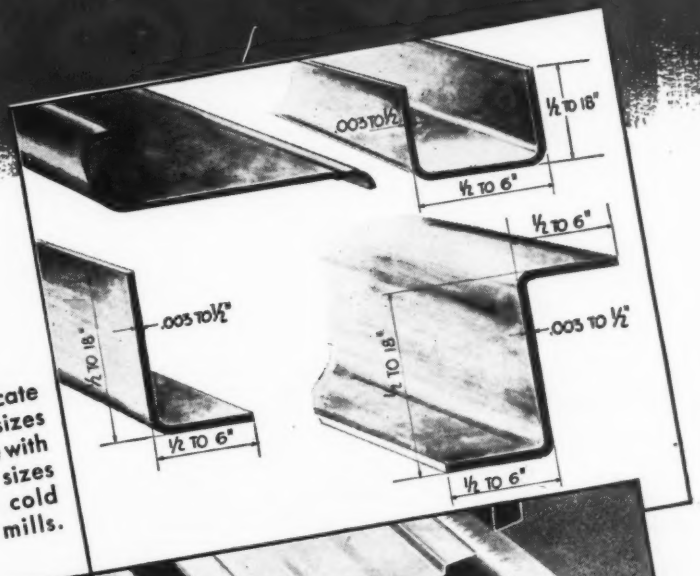
THE No. 4
Circular Sawing Machine for stock up to 16 inches

Write for our Bulletins on [illegible] machines, too.

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING CLEVELAND 13, OHIO

The SEVEN *big advantages of using* COLD-ROLL-FORMED SHAPES

STRUCTURALS • PANELS • TUBING • MOULDINGS • TRIM



Figures indicate range of sizes obtainable with standard sizes of Yoder cold forming mills.

YODER ROLL FORMING MACHINE

SERIES OF SEVEN

No. 1

Uniform Thickness

Flat rolled products are more uniform in thickness than hot rolled or extruded structural shapes. The latter tend to be thicker near the base corners, tapering towards the outside edges. This is an obstacle to uniform, accurate bending, welding and fitting in modern production machinery, and cost is increased because more hand fitting is necessary.

This is only one out of seven equally important reasons why more and more structural shapes, as well as panels, mouldings and trim, are now being produced from flat sheets or coiled strip in Yoder cold-roll-forming mills.

Many operations on sheet metal or plate, formerly considered practical only with older, slower methods, are now being done on a Yoder production line at a small fraction of the former unit cost. This is because Yoder has developed auxiliary equipment for coiling, slitting, straightening, embossing, curving, welding, and cutting-off, tied in with the roll forming, at no sacrifice of speed.

If you suspect there might be any such operations now in your plant, you may consult us without cost or obligation, and with the utmost assurance that if our engineers find high-speed, low-cost Yoder production impractical, we will tell you so.

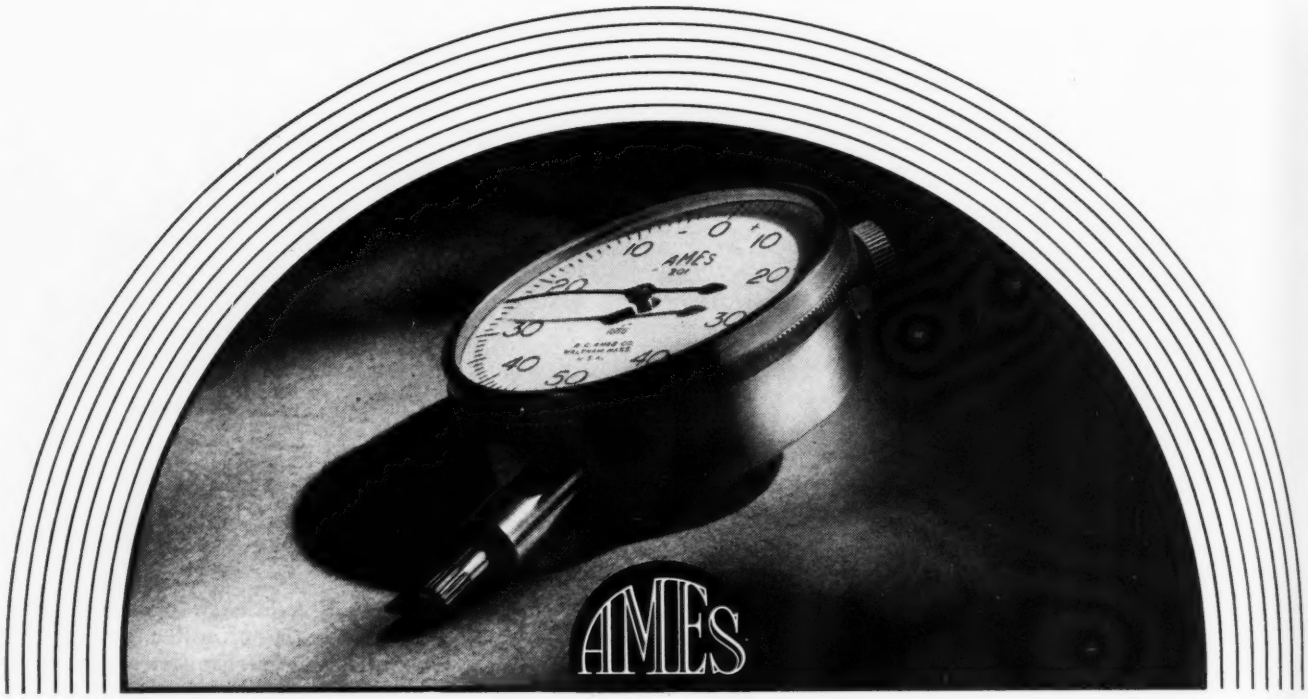
Send for Bulletins, giving valuable data on the advantages and possibilities of cold-roll-forming.

THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

ENGINEERING YODER TRADE MARK MANUFACTURING

ROLL FORMING AND TUBE MILL MACHINERY

36 YEARS' LEADERSHIP • COILING • SLITTING • FORMING • EMBOSSING • CURVING • WELDING • CUTTING-OFF



FOR MILLIONS OF READINGS!

In Dial Indicators you should insist on sensitivity, accuracy, *and long life*—the only kind of indicators that AMES has been making for 50 years.

Many features of AMES design are exclusive. Only the best, the most-lasting materials are used. Add expert craftsmanship in every particular, and you have AMES Indicators . . . that will outlast any other indicator you can buy—at any price. Send for illustrated Catalogue.

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MANUFACTURER OF MICROMETER DIAL GAUGES AND MICROMETER DIAL INDICATORS

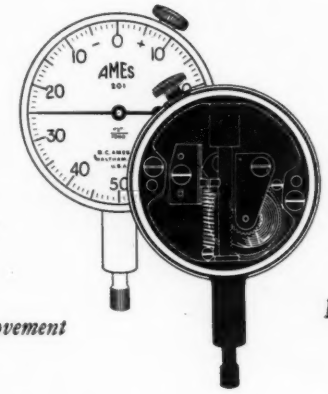
4 Sizes—60 Models

English or Metric Measure

Balance or Continuous Dials

Plain or Compound Movement

Many Graduations and Ranges



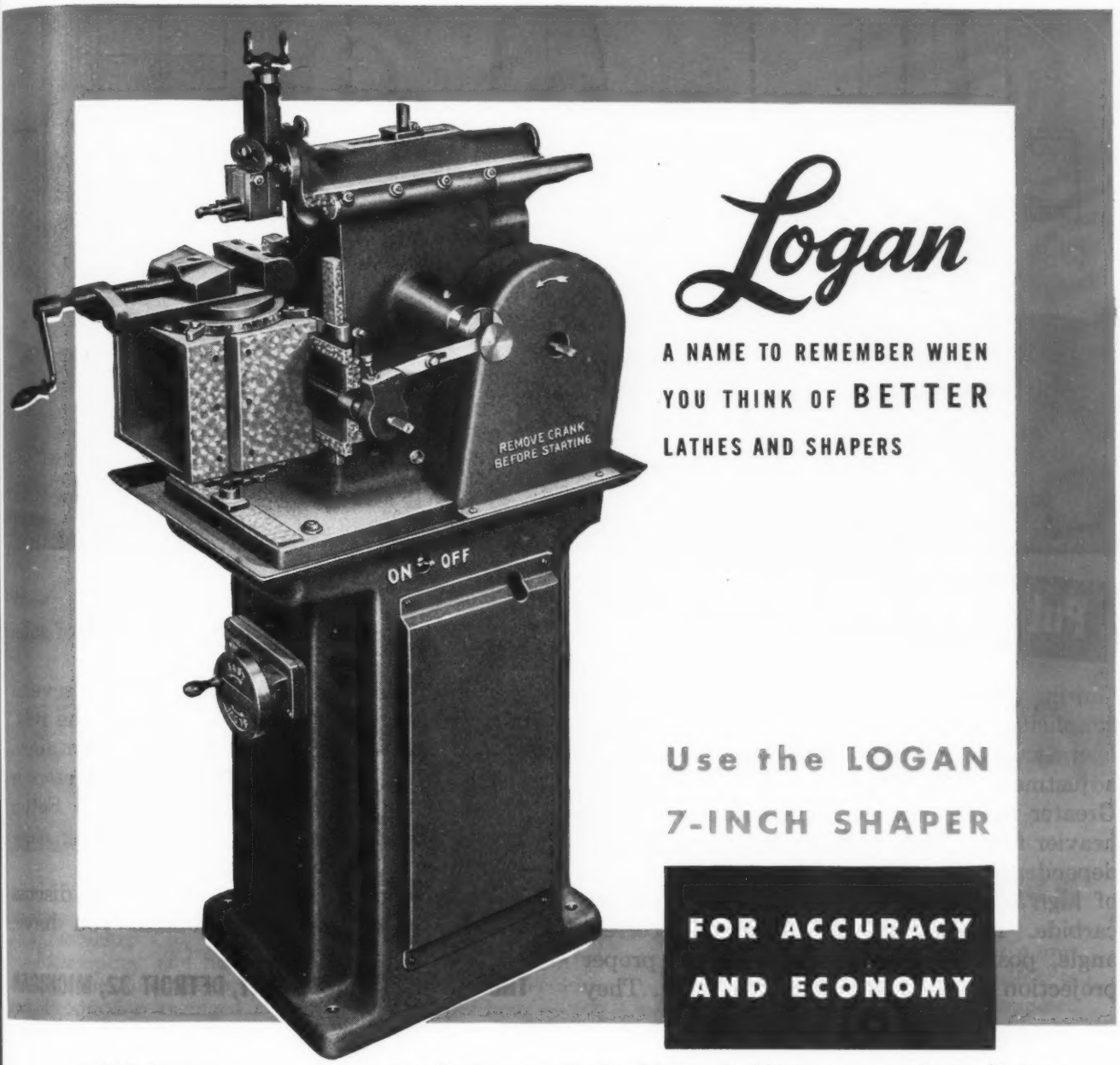
Forged Brass Case and Stem

Hardened Steel Staffs and Pinions

Forged Wheel Supports

Hardened Steel Guidepin and Guide Block

Burnished Hardened Bearings



Logan

A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES AND SHAPERS

Use the LOGAN 7-INCH SHAPER

FOR ACCURACY AND ECONOMY

brief Logan Shaper specifications

Length of ram travel, 7⅜" . . . strokes per minute, "Anyspeed," 64 to 175 . . . length of bearings, main frame, 10". . . length of ram, 16⅛" . . . width of ram, 5" . . . table traverse, 10½" . . . table vertical travel, 5½" . . . table length, 8" . . . table width, 8" . . . table depth, 1½" . . . saddle bearing, 6" . . . toolhead travel, 2⅜" . . . toolhead swivel, 360° . . . toolhead diameter, 4" . . . Cross feeds, 6 (.002, .004, .006, .008, .010, .012) . . . Sprocket and chain drive . . . vise 5" x 5" x 1½" . . . motor, ½ hp, 1750 rpm . . . Height over all, 51" . . . Shipping weight, shaper, stand and motor, 585 lbs.

Any shaping operation involving work within its range can be handled on a Logan Shaper at savings in set-up time and power cost, with no sacrifice in accuracy. Advanced in design, massively built throughout, with extra weight at vital points, and equipped with a positive, slip-proof roller chain drive, the Logan Shaper is smooth and accurate, even on heavy cuts. Any speed desired from 64 to 175 strokes per minute is constantly available through the "Anyspeed" Control. Operation is simple. Speeds can be changed instantly, without stopping the motor or shifting the belt. The ram is micro-set by a simple screw adjustment. There are six automatic feeds in either direction, from .002" to .012", with a half turn of the feed handle reversing the feed. The tool head may be swiveled and instantly re-set to center by means of tapered locating pins, an exclusive Logan feature. In any shop, large or small, the Logan Shaper quickly proves its all-round efficiency, wide range of feeds and speeds, and accurate, economical operation. Full particulars at your Logan dealer's, or on written request.

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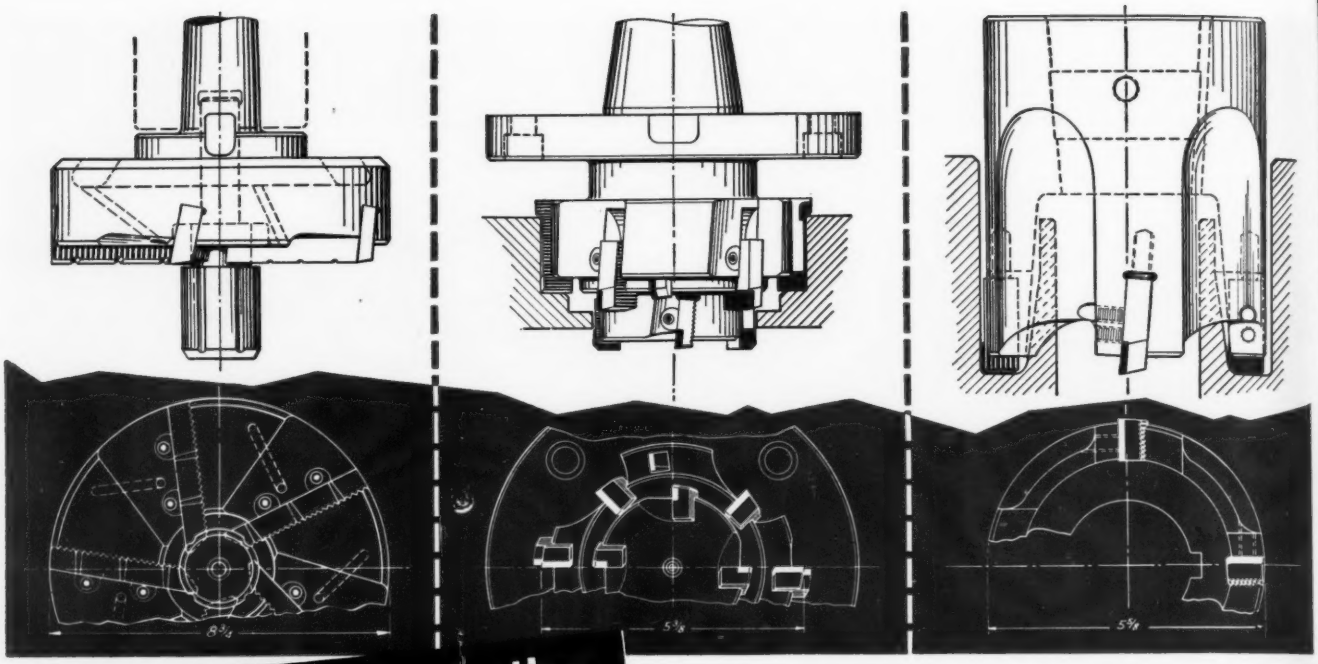
R-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS



Put Teeth into Production

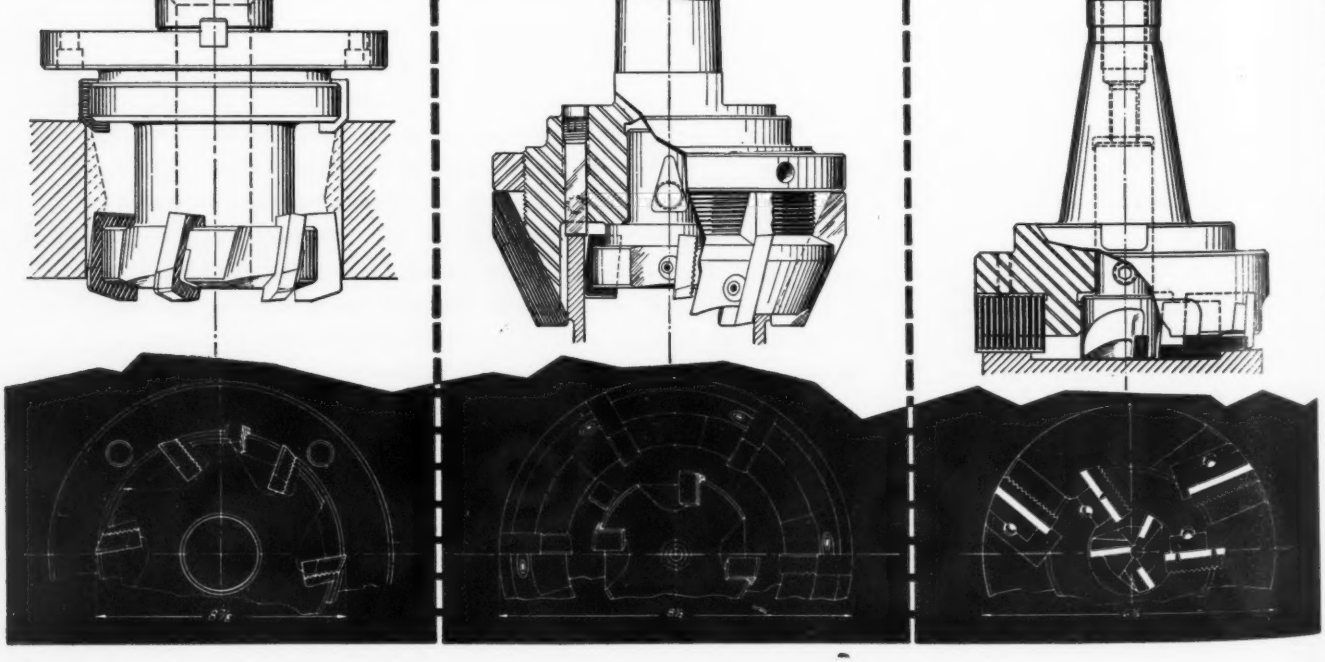
Gairing inserted blade cutter-heads combine simplicity, rigidity, and adaptability (multiple operations in one head) with ease and speed of adjustment.

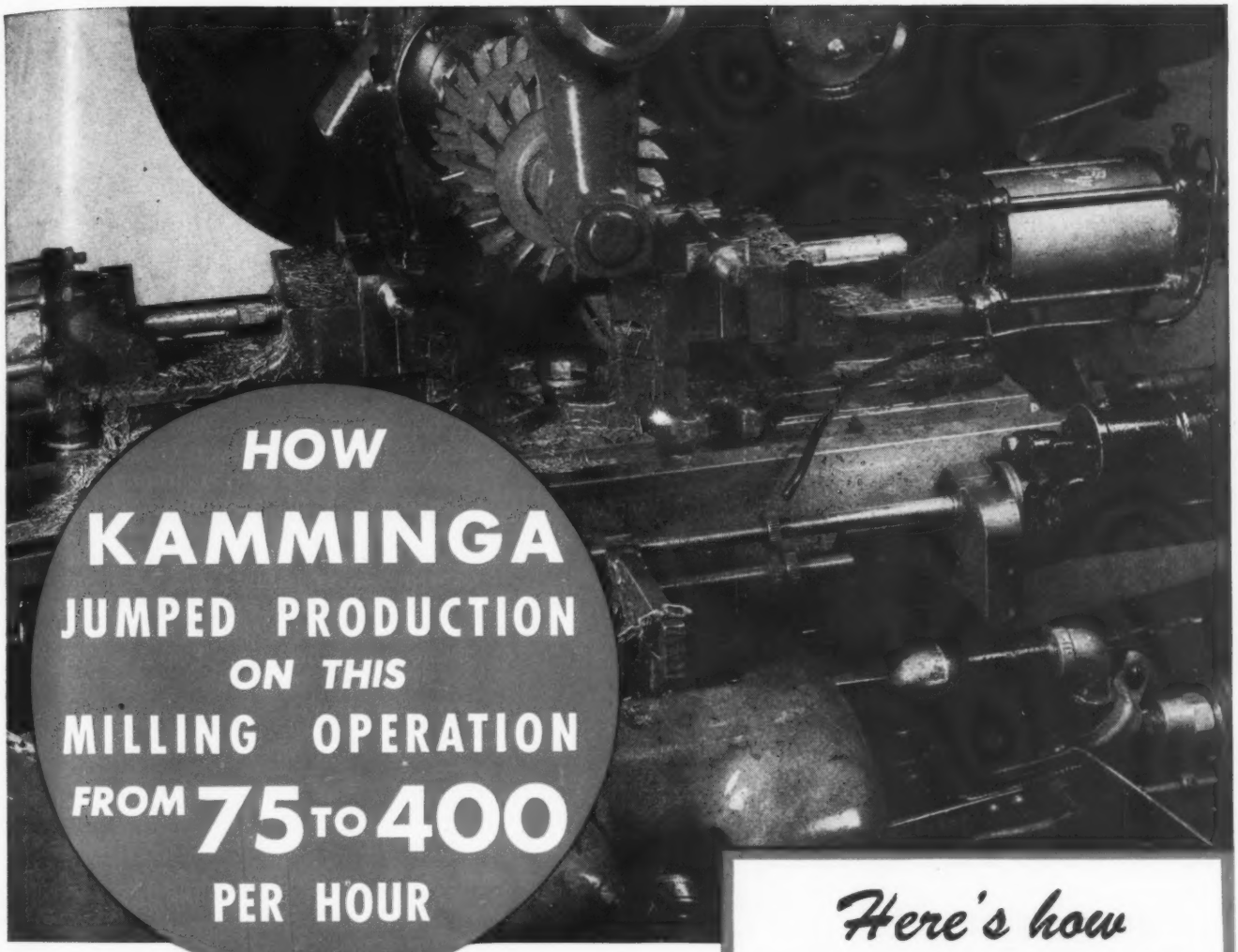
Greater rigidity increases their ability to take heavier feeds. They provide solid, positive, independent support to the blades which may be of high speed steel, hard alloys, or tungsten carbide. Blades are designed with correct angle, positive or negative rake, and proper projection of the blades from the body. They are replaceable at a fraction of the cost of solid tools.

Gairing cutter-heads efficiently combine several cutter operations in one tool because the relation of each cutting edge is easily maintained and perfect concentricity between diameters is assured. *Also*—and this is important: Setup time on machining operations involving close tolerances is greatly reduced.

Our Engineering Department will gladly discuss any heavy cutting tool problem you have.

THE GAIRING TOOL COMPANY, DETROIT 32, MICHIGAN





HOW KAMMINGA JUMPED PRODUCTION ON THIS MILLING OPERATION FROM 75 TO 400 PER HOUR

Milling of this anchor pin in the plant of the Kamminga Manufacturing Co., Grand Rapids, had been handled by hand clamping, and hand milling one end at a time. After milling one end, the operation was repeated for the other end. Production averaged 75 complete pieces per hour — 600 per 8-hour shift.

A Bellows Senacon Field Engineer recalled a somewhat similar operation described in one of the Bellows Senacon Foto Facts Files. Working with Kamminga production men they converted a standard Nichols hand mill into a fully automatic unit — a unit that jumped production 533% — from 600 to 3200 complete pieces per shift — increased cutter life 300% — and cut labor costs per piece more than 80%.

The production increase obtained by Kamminga Manufacturing Co. is not unusual. Production increases ranging between 40% and 500% are obtained wherever manual feeding and clamping on milling machines, drill presses or other machine tools is replaced with Bellows Senacon "controlled-air" power.

Here's how IT WAS DONE

A Bellows Senacon "continuous action" Air Motor was installed to traverse the bed against two opposed Bellows Senacon Hydro-Checks (hydraulic resistance units). Two Bellows Senacon Air Vises, synchronized to open and close automatically, were set up to hold the part. The operator loads one vise while a second part is under the cutter. Once the unit is started all operations, except loading and unloading, are continuous and automatic.

Bellows Senacon Co.

AKRON 10, OHIO

Would you like the current Foto Facts File without cost or obligation? *Send coupon, today.*

Please send me the current Bellows Senacon Foto Facts File, and the detailed story of the milling operation described in the January issue of Machinery.

Name.....

Company.....

Address.....

McGILL *Cam Follower* BEARINGS

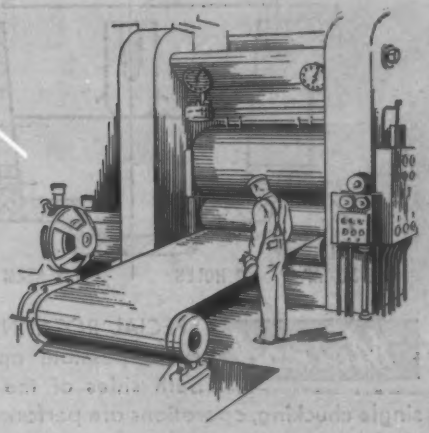
A full type needle roller bearing, with rounded end rollers. These give maximum surface for taking the severe shock of intermittent loads. Unusually sturdy outer race, with no small retaining washers or delicate parts. Possibility of becoming disassembled during operation is eliminated regardless of the shape of the cam. Bulletin CF-40-A gives specifications and load capacity. Write for copy.

McGILL
MANUFACTURING COMPANY, INC.
Manufacturers of Ball and Roller Bearings
VALPARAISO, INDIANA

THE SHEFFIELD MEASURAY

MEASURES THICKNESS CONTINUOUSLY WITHOUT TOUCHING THE WORK

METALS
Sheet · Strip · Foil



RUBBER · PLASTICS
COATED FABRICS
FILMS · PAPER

Problems inherent in contact gaging of continuous strip materials are completely eliminated by the installation of the Sheffield Measuray. *No part of the Measuray touches the work.*

Whether it be hot or cold metal strip, or non-metallic materials, the Measuray provides amplification and sensitivity to check thickness to accuracies beyond any known industrial requirements.

The Measuray may be traversed across the moving sheet to obtain a check at any point, or an average check. It can be adapted to actuate an indicator, signal lights, or a recorder, singly or simultaneously.

A combination of X-Ray and electronics is used as the gaging principle to measure the mass—therefore temperature, weaving of the stock, speed of motion, and proximity of the gaging head to the work are relatively unimportant factors. The Measuray conforms to the safety standards of American Standards Association and National Bureau of Standards.

Write for complete information. Better yet, bring samples to Sheffield in Dayton and check them on the Measuray.

For an early installation (orders exceed production) see the Measuray in action and arrange for a Sheffield factory representative to visit your plant and draw up plans for your application.

Standard gages and measuring instruments shipped within 24 hours.

SHEFFIELD MASTER CRAFTSMEN

Real job security is provided only by plentiful incoming orders shipped at prices consumers can afford and want to pay . . . modern machines help make this possible.

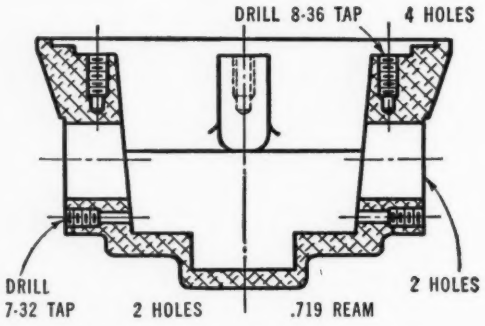
THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

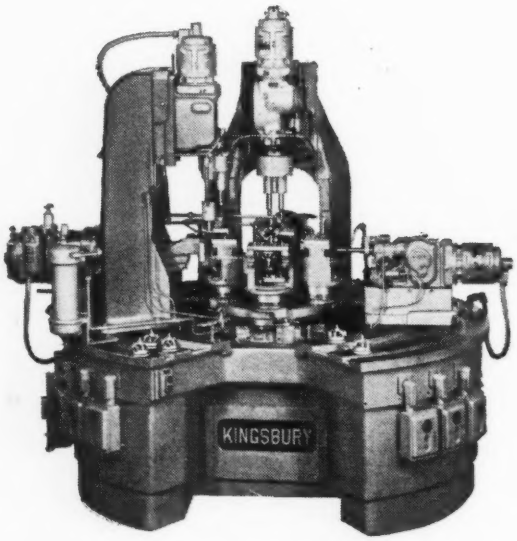
MACHINE TOOLS · GAGES · MEASURING INSTRUMENTS · CONTRACT SERVICES 2327

Multiple Drilling for High Production

Problem Drill, tap and ream this die cast motor end bell. Accurate location is important.

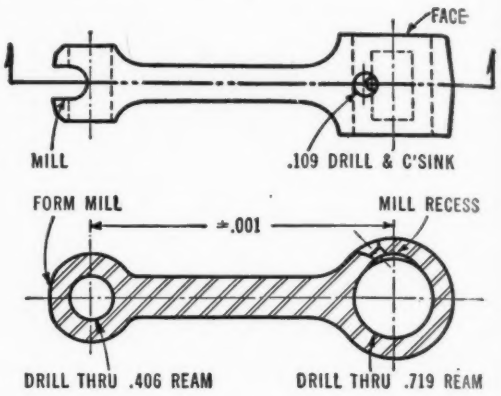


Method SPECIAL ROTATING FIXTURES make possible operations on both sides of the piece. In a single chucking, operations are performed progressively on one side at the three working stations, then the operator rotates the fixture 180° and the opposite holes are machined.

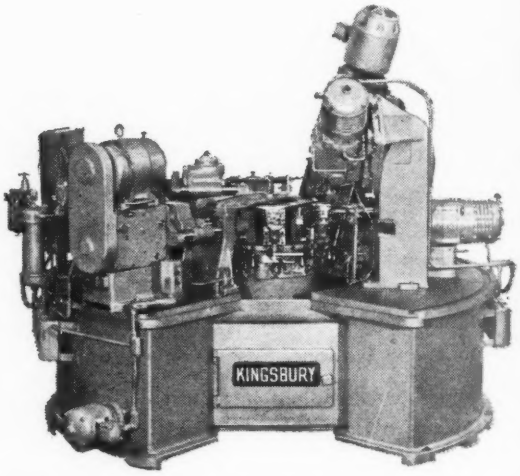


Results 220 PIECES PER HOUR GROSS and substantial savings costs. If your high production work requires multiple drilling up to an inch or so in diameter, let us propose a machine that will be completely designed and tooled ready to do your job. Send us a print and outline the operations and hourly production desired.

Problem Machine this forged steel connecting rod as shown.



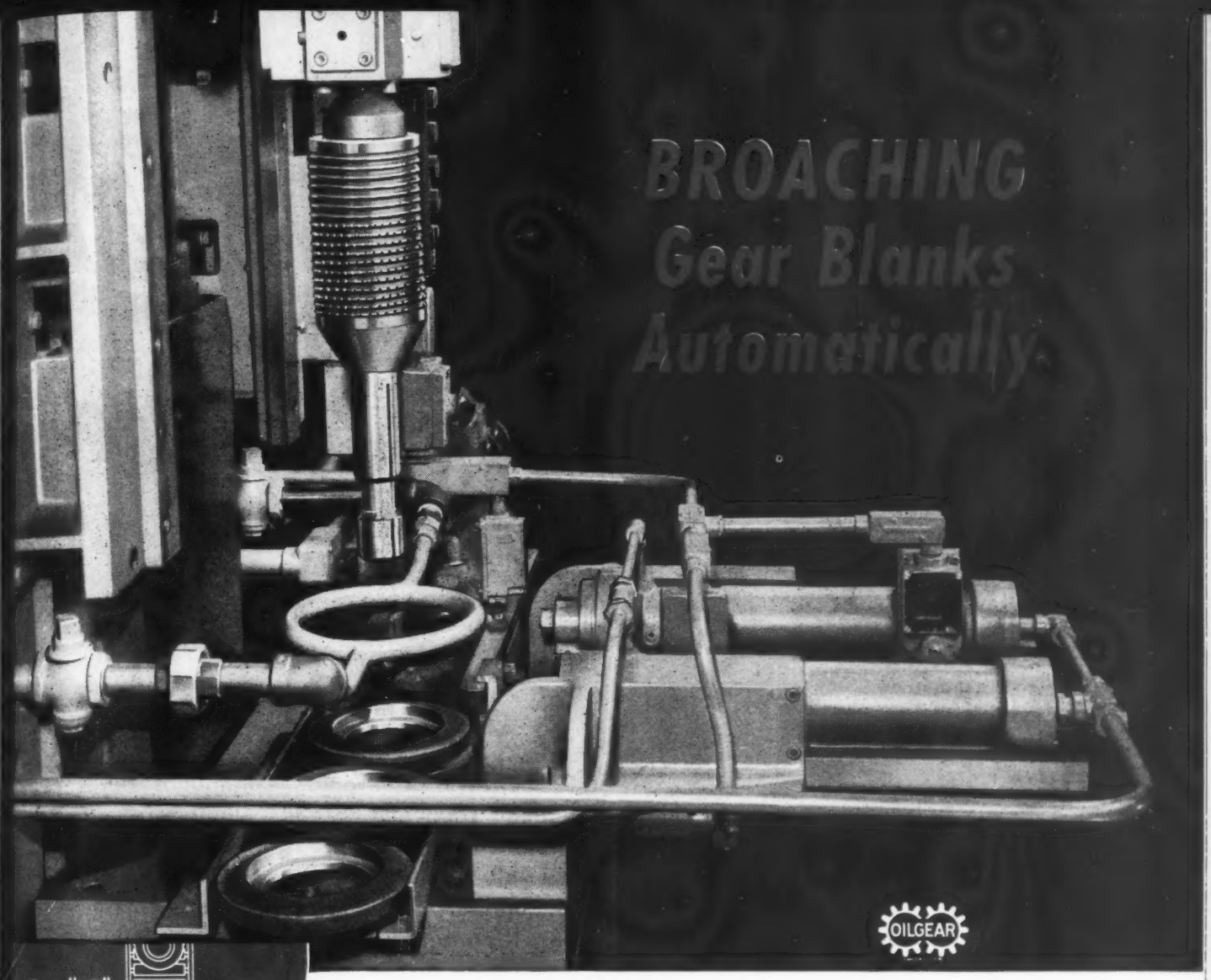
Method THE HARD-TO-REACH RECESS is milled by means of a unique device that automatically tilts the head-unit upward to make a plunge cut at the proper time. The holes are accurately located because the work is not disturbed in the fixture between operations. The machine is a nine spindle "auto-index" with eight identical work fixtures.

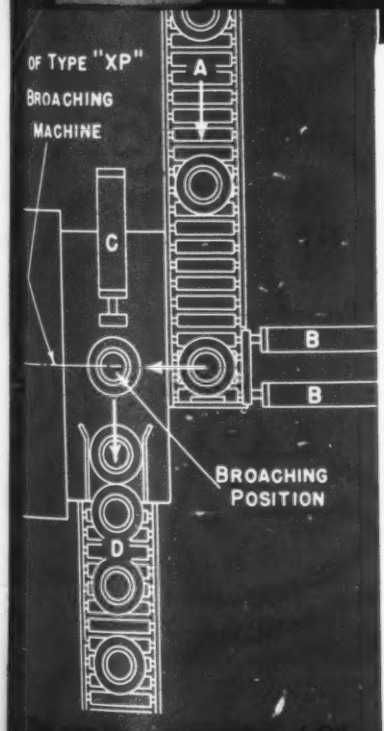


Results 150 PIECES PER HOUR GROSS. The unit cost is lower now because of more output per man hour, fewer rejections, less handling and less floor space. The initial cost is lower than most special purpose machines because the indexing, drilling and milling units and the base are all standard.

KINGSBURY MACHINE TOOL CORP., KEENE, N. H., U. S. A.

Kingsbury





Oilgear Vertical Pull-Down Broaching Machine continuously loads, broaches and unloads hypoid bevel gear blanks . . . *automatically*. This Oilgear Type "XP" Vertical Pull-Down Broaching Machine with automatic loading and unloading mechanism is operating at the Fort Wayne plant of the Spicer Mfg. Co. Its job is to finish broach holes in the forged steel hypoid bevel drive gear blanks fed to it from a boring machine by means of a conveyor.

Two fluid power cylinders remove the blank from the conveyor and place it in the broaching position on the machine. As tool descends, shank accurately locates blank. Tool is pulled downward to broach part. Another fluid power cylinder pushes the finished part onto a second conveyor which takes it away. There's no manual loading—no levers or buttons to operate—no manual threading of part over tool shank—no cautious centralizing of part by hand—no manual handling of tool—no manual unloading. All operations are automatic, continuous and unattended.

The Oilgear Automatic Broaching Machine removes approximately .020" of stock on the diameter and produces 225 finished ring gear blanks per hour. Other sizes of bevel gear blanks can be broached on the same machine by changing the broaching shells on the tool steel bar.

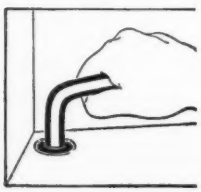
If you are looking for faster production and lower costs, investigate Oilgear Broaching Machines, either vertical or horizontal for every type of internal and external broaching. They provide high broaching and return speeds, infinitely adjustable. They make more efficient use of electric power hence require smaller motors. They make more efficient use of oil medium hence require much smaller reservoirs. They provide manual, semi-automatic and full automatic control at no extra cost. THE OILGEAR COMPANY, 1312 W. Bruce St., Milwaukee 4, Wis.

Oilgear Fluid Power

UNRETOUCHED PHOTO ETCHED CUTAWAY
HOLO-KROME SOCKET HEAD CAP SCREW

Completely Cold Forged

INTERNAL WRENCHING



. . . . THE BETTER FASTENING METHOD

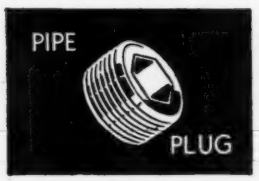
Exclusively Holo-Krome! Continuous Fibres running from end to end — uninterrupted, unbroken and unsevered! Accomplished exclusively by the Holo-Krome patented method of Completely Cold Forging and sold thru Holo-Krome Industrial Supply Distributors under the registered trade mark name "FIBRO FORGED" Socket Screws . . . Specify "Holo-Krome" and get these guaranteed unfailing performance Socket Screws.

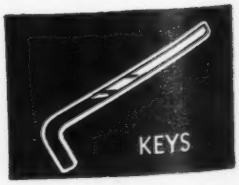
THE HOLO-KROME SCREW CORP.
HARTFORD 10, CONN. U. S. A.

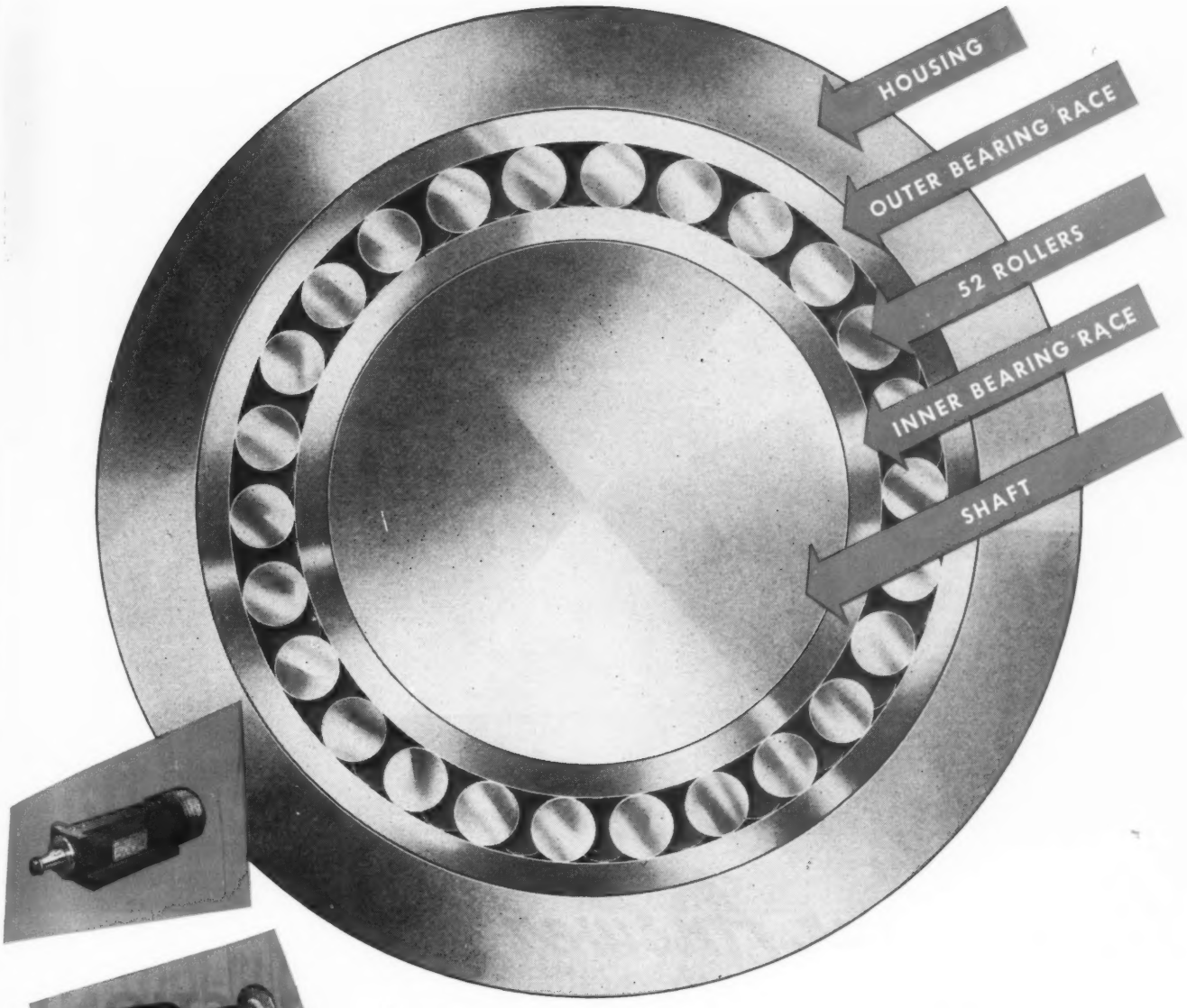
HOLO-KROME

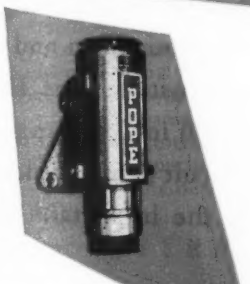
fibro forged

INTERNAL SOCKET SCREWS WRENCHING









Pope Precision Grinding Spindles like these are equipped with double row roller bearings of enormous excess capacity, as shown above. Each bearing is given the exact radial preload to assure best grinding finishes and long life.

SEE FOR YOURSELF

Why POPE PRECISION SPINDLES *have* AMPLE ABILITY *to stand up under hard work*

Note the practically CONTINUOUS BEARING SUPPORT for the shaft provided by the SKF Double Row Roller Bearing. This insures the smooth running necessary for FINE FINISHES on ground surfaces.

And remember — these are ROLLERS you are looking at. For *rugged ability* to *carry loads easily* and *smoothly* for *long periods, there's nothing like a roller.*

No. 39

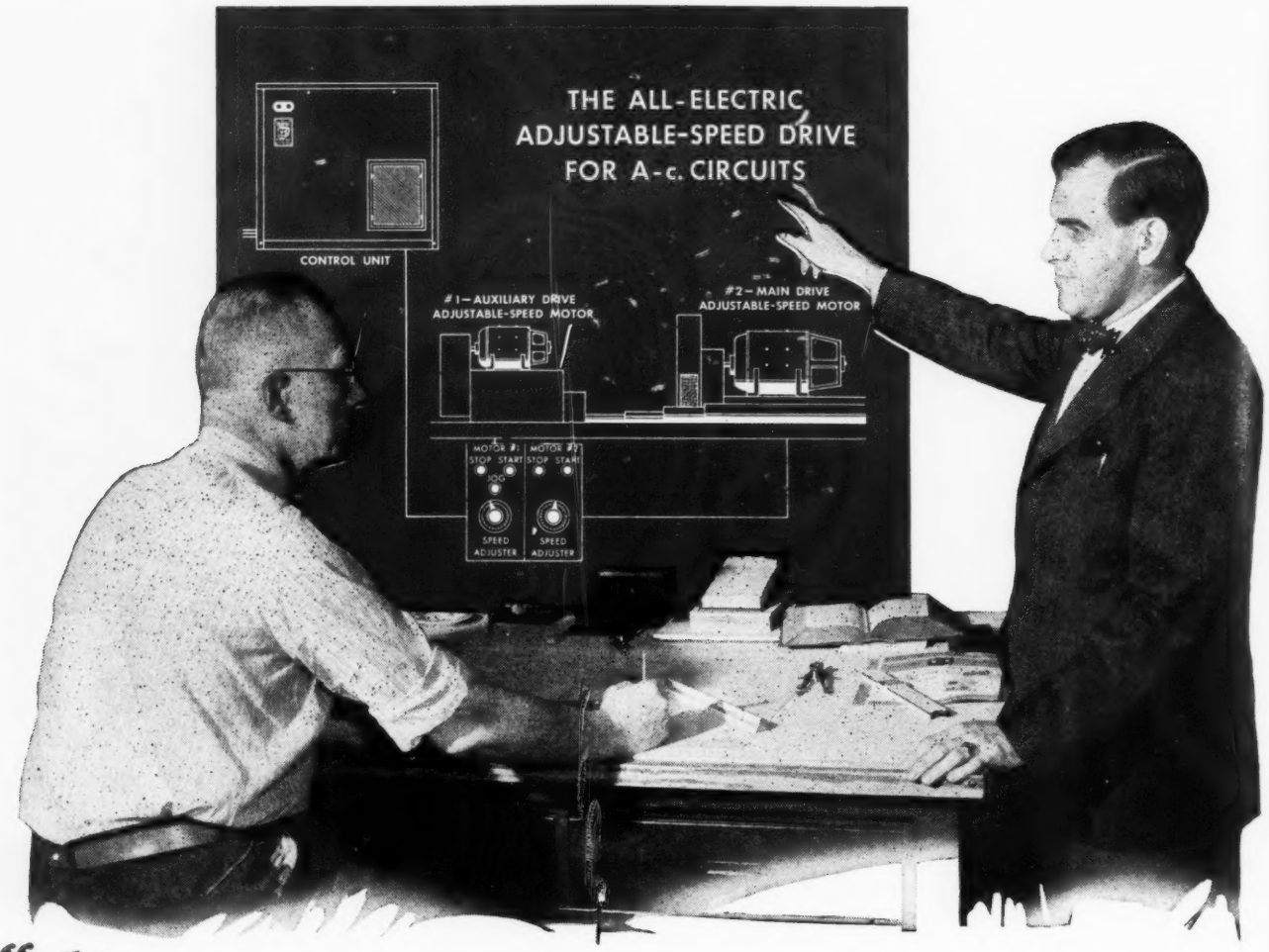
POPE

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES



"Here's your Answer TO UNLIMITED SPEED SELECTION!"

Reliance V★S is the *All-electric, Adjustable-speed Drive,* which operates from *A-c. Circuits.* The flexibility it brings to machine operations can increase your production and cut your costs—as it has already done in thousands of installations. Here is the simplest, most efficient means of securing an infinite range of stepless speed changes from your plant's A-c. circuit for all processing jobs. Bulletin 311 will bring you more of the important facts about the V★S Drive. Write for it today!

RELIANCE V★S DRIVE

Conveniently-packaged, space-saving V★S Drives are available from 1 to 200 horsepower

RELIANCE ELECTRIC & ENGINEERING CO.

1077 Ivanhoe Road • Cleveland 10, Ohio

Appleton, Wis. • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Denver • Detroit • Gary • Grand Rapids • Greenville Houston • Kansas City • Knoxville • Los Angeles • Milwaukee • Minneapolis • New Orleans • New York • Pittsburgh Portland, Ore. • Rockford • St. Louis • San Francisco • Seattle • Syracuse • Tampa • Tulsa • Washington, D. C. Sao Paulo, Brazil

RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"

CUSTOM-BUILT TO THE MOST *Exacting Specifications*

G-S SMALL GEARS are cut to extremely close tolerances. Each specification, however exacting, is executed and inspected with a degree of precision seldom equalled in small gear manufacture. Here, every facility has been provided for speedy, uniform quantity production: 1. Skilled engineers and designers; 2. Modern methods and machinery; 3. Trained operators; 4. Intensive series of inspections; 5. All operations under the constant supervision of *specialists*—men long experienced in producing Fractional Horsepower Gears exclusively. That's why G. S. Gears perform so smoothly and dependably for years, and that's why *each* G. S. Gear measures up to the same, exacting specifications. If Small Gears, from 12 to 96 d.p., are an important consideration in YOUR plans, for your own best interests, let our organization of specialists tackle the job! Consult with our engineers, or write today for a copy of the new G. S. catalog bulletin.

SEND FOR OUR 4-PAGE CATALOG

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

Are You Missing a Bet?

Here's what 32 ALUNDUM is

"50% faster cutting, 100% longer wheel life" — **Surfacing broaches**

"Ground 3600 pieces per wheel compared with 1200 to 1500 previously" — **Surfacing cast iron with segments**

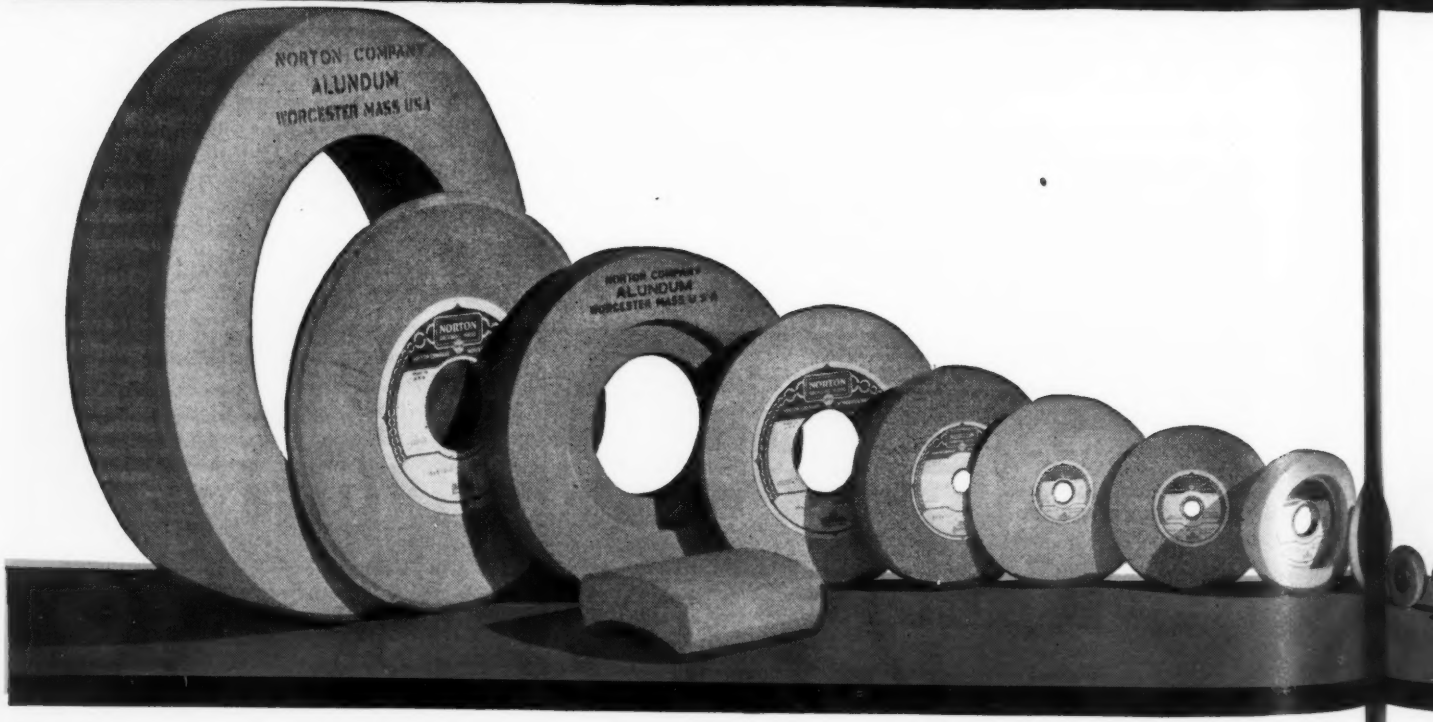
"Gave over 40 holes per wheel compared to 10 for best previous wheel" — **Internal grinding of pump part**

"Ground 30 high speed steel crank lathe tools compared to 23 tools for competitive wheel" — **Sharpening tools**

"Gave over 1000 pieces per dressing compared to 300 previously" — **Surfacing razor parts**

"Wheel life of five weeks as compared with four weeks previously; 50 pieces per dressing compared with 20" — **Cylindrical grinding of shafts**

"Required 1/3 less dressing. Lasted 1/3 longer. Better finish, cooler cutting" — **Surfacing chrome steel**



...M is doing.....

"Removes .002 – .003'' per pass on large Hi-carbon and Hi-chrome dies as compared to .0005'' with previous wheel" — **Surfacing dies**

"75% increase in life. Required no dressing" — **Sharpening file chisels**

"Wheel life 15% longer than competitive wheel. Required dressing only once every two days, no loading " — **Snagging forgings**

"Lasted 16 days against three days for competitive wheels and cut better" — **Surfacing dies with segments**

and HERE'S WHY!

The crushing process used to reduce ordinary abrasives to commercial sizes produces many grains with flat surfaces and long edges. When these grains are bonded in a wheel they often locate with a flat area exposed in the surface instead of a useful cutting point.

Because the grains of 32 ALUNDUM abrasive form in the electric furnace as complete crystals each one has sharp points on all sides. No matter how these uncrushed grains are bonded into a wheel one or more cutting points will be exposed.

This means that in a wheel of 32 ALUNDUM abrasive there are many more cutting points doing the work. And these cutting points are extremely resistant to dulling because "32" is over 99% pure fused alumina.

The greater number of longer-lasting cutting points doing the work means that a 32 ALUNDUM grinding wheel removes stock more rapidly. Because grinding heat is spread over more points, and points that stay sharp longer, "32" wheels cut cooler. Because there are more points doing the work and points that don't dull quickly, 32 ALUNDUM wheels require fewer dressings and last longer.

When ordinary abrasives are crushed to size it results in many grains with flat sides. When such grains are bonded into a wheel it is often a flat side that is exposed in the surface instead of a useful cutting point.

No crushing to size is necessary with 32 ALUNDUM abrasive. The grains form as individual crystals — pointed on all sides. No matter how they are bonded into a wheel one or more cutting points are exposed.

NORTON COMPANY, WORCESTER 6, MASS.

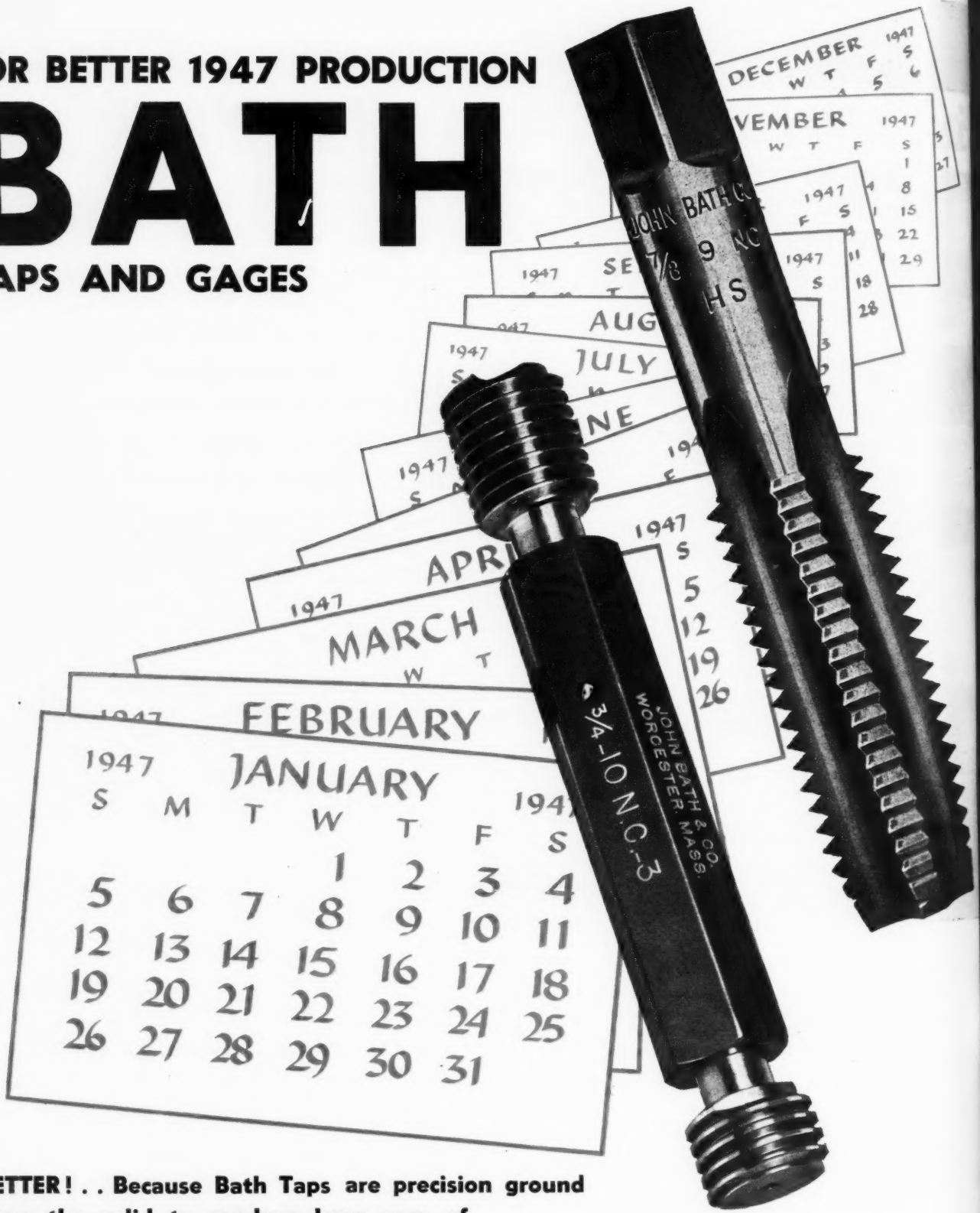
Distributors in All Principal Cities

NORTON ABRASIVES

FOR BETTER 1947 PRODUCTION

BATH

TAPS AND GAGES



BETTER! . . Because Bath Taps are precision ground from the solid to produce long runs of accurate threads, and to take repeated resharpenings.
BETTER! . . Because Bath Gages, with their Patented Chip Cleaner, speed inspection and reduce rejects due to chip interference.
For better . . . more accurate . . . more profitable production in 1947, standardize on BATH TAPS AND GAGES.

JOHN BATH & COMPANY, INC., Worcester, Mass., U. S. A.

UND DESIGN + VIBRATION CONTROL = SUPERIOR PRODUCT

LORD
BONDED RUBBER
Shear Type
MOUNTINGS

Apply this simple formula to new products, particularly while in the blueprint stage, and watch its uncanny magic develop answers that bring a better product, lower manufacturing costs, and increased sales. Isolation of vibrational stresses frequently enables redesign for lighter weight, increases life of bearing surfaces, and protects vital parts.

Best of all, you will find the answer to your search for quicker and easier sales. Customers are enthusiastic when they find your usual high quality of performance coupled with new, *SMOOTHER* operation. Noise and vibration—the principal causes of industrial fatigue—no longer take their toll of efficiency and accuracy. Vibration Control cushions the nerves of industry.

For best results, bring your vibration problems to Vibration Control Headquarters. The service of LORD Vibration Engineers is yours for the asking. Write today for a vibration analysis of your new products.

ORD MANUFACTURING COMPANY, ERIE, PA.

FIELD OFFICES { New York, N.Y. Detroit, Mich. Washington, D.C. Chicago, Ill. Burbank, Cal.
Canadian Representative: Railway & Power Engineering Corp., Ltd., Toronto, Canada.

Every genuine Lord Mounting carries the name "LORD" embossed in the rubber or in raised letters on the forgings.

FOR BETTER 1947 PRODUCTION

BATH

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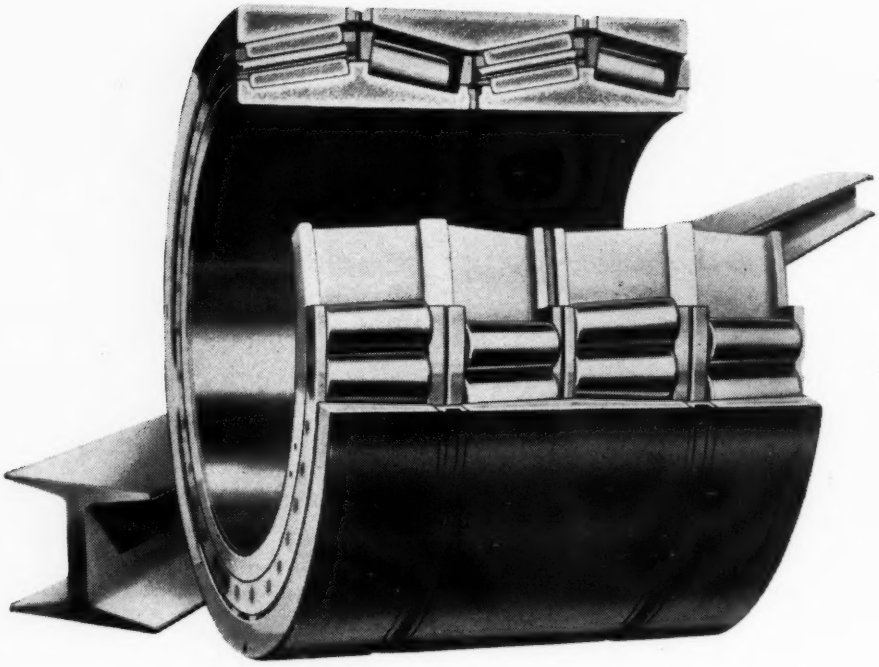


Rigidity for heavy loads . . .

is as important in a roll neck bearing as in the finished beam turned out by the rolling mill. Greater rolling mill rigidity can be assured

With Torrington Roll Neck Bearings . . .

to meet today's demand for closer and closer tolerances in the production of plate, strip and structural steel. Maximum capacity and precision operation are secured in Torrington four row *Tapered* Roller Bearings by the use of a maximum number of rollers, positively spaced and guided by pin-type retainers.

The experience of the Torrington Company in designing and building special or standard bearings, large or small, to meet many exacting requirements, is at your disposal. Bring *your* friction problems to our engineers.

THE TORRINGTON COMPANY

SOUTH BEND 21, IND. TORRINGTON, CONN.

Offices in All Principal Cities

TORRINGTON BEARINGS

• NEEDLE • SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • BALL •

GET...

Fast Action

✓ *High Accuracy*

✓ *Easy Control*

...in STANDARD "LOGAN" AIR and HYDRAULIC PRESSES

. . . for SPECIFIC APPLICATIONS and GENERAL SHOP WORK

STANDARD LOGAN HYDRAULIC PRESSES

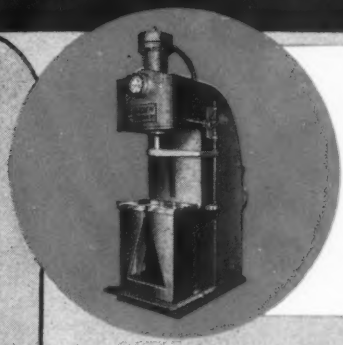
Standard hydraulic presses can be selected from the Logan line to effectively perform a wide range of specific applications and general shop work. Logan press features are bringing higher production, greater accuracy, reduced spoilage and other profitable advantages to many fabricators of metal, fiber, ceramic, plastic, etc.

High and low platen "C" frame presses are built for both automatic and semi-automatic cycling. This assures high precision and uniformity, and reduces operator fatigue. Quick, positive response is obtained through Logan's "rapid loading and fire" control mechanism. The unusual ease of control minimizes dependence on the operator's strength or skill.

Self-contained hydraulic circuits provide ample power for any operation within the capacity of each press. The space-saving design reduces floor space requirements.

SPECIAL HYDRAULIC PRESSES

Designed and built by Logan for your specific forming, forcing, piercing, gauging, shearing, assembling and many other operations. Type of press, gap, ram stroke, table and controls specially selected for most effective handling of your particular requirements.

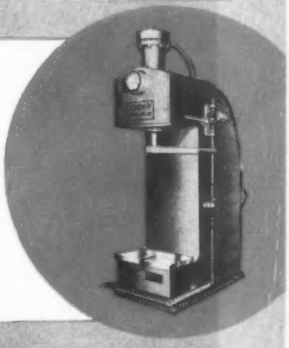


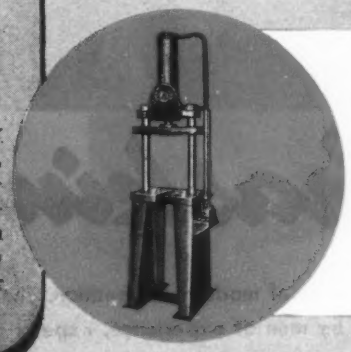
HIGH PLATEN "C" FRAME PRESS FOR FORCING, FORMING, BROACHING, PRESSING, ASSEMBLING AND OTHER OPERATIONS

Equipped for automatic and semi-automatic cycling. Dual controls—hand lever and foot treadle. Self-contained hydraulic circuit. 10 STANDARD SIZES TO 100 TONS CAPACITY.

LOW PLATEN "C" FRAME PRESS FOR LARGE, BULKY, HARD-TO-HANDLE WORK

Same construction as HIGH PLATEN press except for larger gap between ram and platen. This permits handling assemblies, sub-assemblies and parts which are large or difficult to hold; also pressing of gears, bearings, collars, etc., on long, hard-to-handle shafts and arbors. 10 STANDARD SIZES TO 100 TONS CAPACITY.





2 TIE ROD TYPE UTILITY PRESS FOR MULTIPLE PURPOSE LIGHT DUTY WORK

All-purpose hydraulic press for manufacturing, technical, and laboratory work. Upper platen is removable. Floor and bench mounting types with hand or foot control valve. STANDARD SIZES IN 5, 15 and 25-TON CAPACITIES.

STANDARD LOGAN AIR PRESSES

FLOOR OR BENCH TYPE TOGGLE-ACTION ARBOR PRESS
For press-fitting arbors, mandrels, bushings and bearings, and general run press operations. Hand or foot operated air control valve. 10 STANDARD SIZES WITH RAM PRESSURES FROM 2,500 LBS. AT 80 LBS. LINE PRESSURE TO 57,700 LBS. AT 100 LBS. LINE PRESSURE.

ADJUSTABLE BENCH TYPE ARBOR PRESS
For light duty pressing, forcing, assembling, marking, punching, straightening, shaping, etc. Air cylinder height above bed is adjustable. AVAILABLE IN RAM PRESSURES FROM 565 TO 2827 LBS.

UNIVERSAL GUIDED-RAM BENCH TYPE ARBOR PRESS
(*Air or Hydraulic*)—For light duty precision operations such as pressing, forming, shearing, punching, stamping, assembling, etc. Movable platen is gibbed to ways. Press may be used as a unit, or in series for either synchronized or progressive operations. RAM PRESSURE ¾ TON WITH AIR ACTUATION, 1½ TONS HYDRAULIC.

ENGINEERING HELP—Logan engineers will gladly work with you in selecting the most efficient *standard* air or hydraulic press for your work requirements, or in designing *special* presses for specific jobs. No obligation.

Write for this New Free Catalog

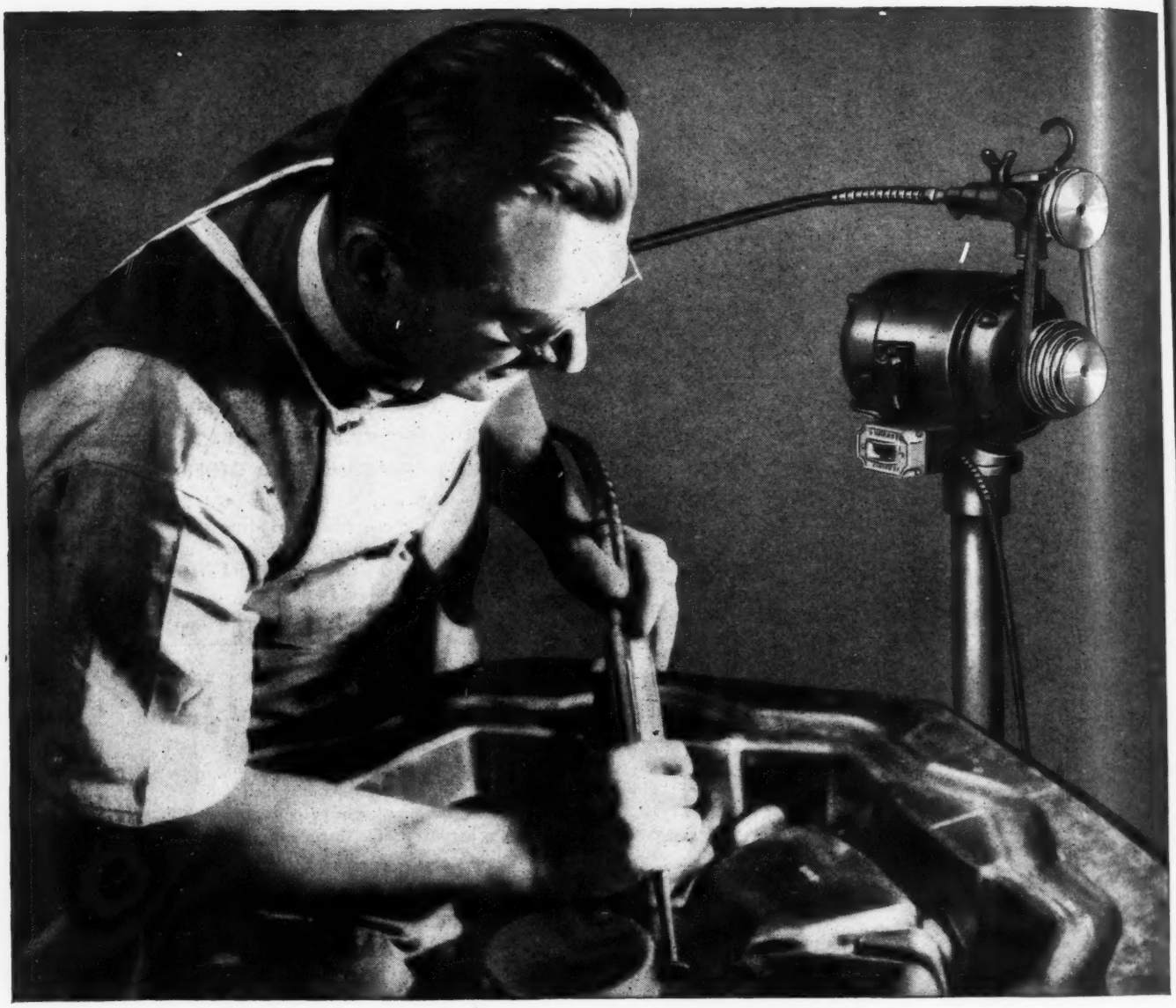
Get your copy of Catalog 51 for complete specifications on Logan Air and Hydraulic Presses. Also includes suggestions on best type of press for every type of job.

Logan SAVES ★TIME ★EFFORT ★MOTION

Air and Hydraulic Equipment

LOGANSPORT MACHINE CO., INC.
910 CENTER AVE.
LOGANSPORT
INDIANA

CHUCKS • CYLINDERS • VALVES • PRESSES • SURE-FLOW COOLANT PUMPS



INSIST ON haskins QUALITY

Haskins Flexible Shaft Machines meet the demands of modern competition. They are *quality* machines—built of quality material by men of experience, experts in their line. The flexible core, made of special Swedish music wire—the heavy duty rubber fabric casing—the removable casing ends—the ball bearing grease-sealed spindle—the amply-powered motor—these are outstanding features.

And there are literally hundreds of specific operations for these portable tools . . . grinding, drum and disc sanding, rotary filing, wire brushing, buffing and polishing. But whatever the job, a Haskins will do it better—speedily and economically, yet carefully and accurately, too. Send for details.

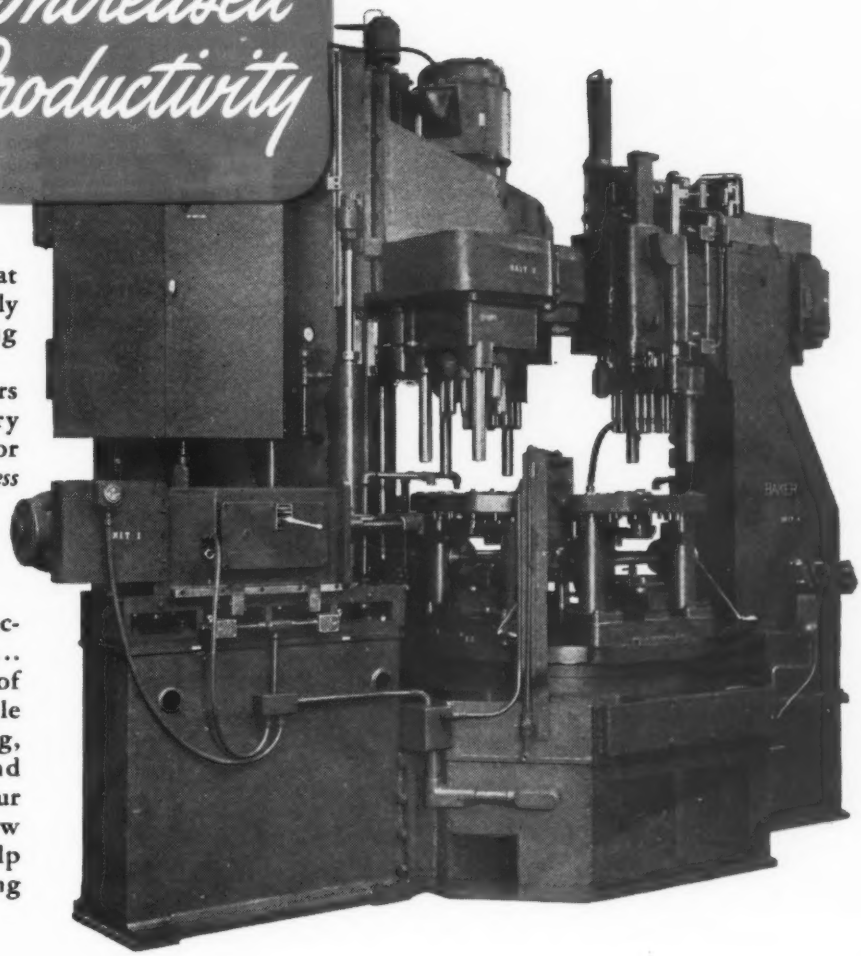
HS-4, ½ h.p. multi-speed, countershaft unit, 1800 to 7200 R.P.M., mounted bench height on caster base, 360° swivel.

R. G. HASKINS COMPANY
617 S. CALIFORNIA AVE. • CHICAGO 12, ILLINOIS

HASKINS

haskins
FLEXIBLE SHAFT EQUIPMENT

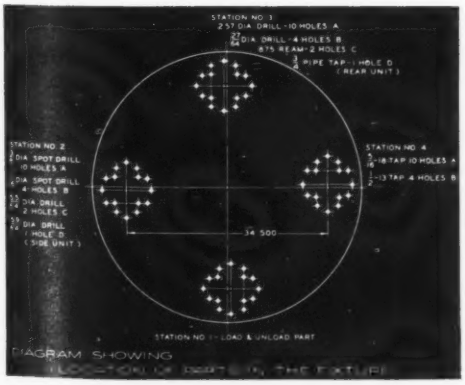
BAKER ... KEY TO Increased Productivity

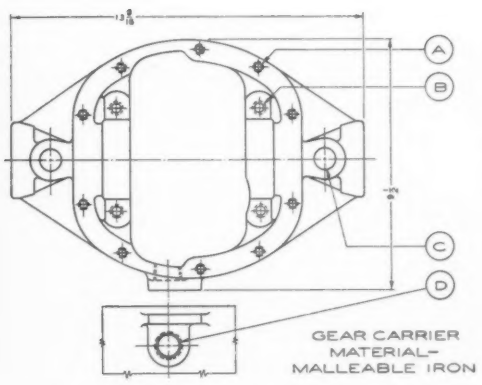


A recent survey of industry shows that *new methods* and *new machines* are highly important factors today in obtaining *increased productivity.*

This is particularly true among users of Baker Machines—because every Baker is designed to make it easier for the operator to produce *more* in *less* time with *less* effort!

By combining operations and reducing work-handling, Baker Machines offer the right set-up for greater production and improved accuracy. Baker units are highly flexible... can be adapted to a wide range of operations including single or multiple spindle drilling, boring, reaming, counterboring, hollow milling and chamfering. Send us details about your job-problem. We'll be glad to show you how a Baker Machine will help you beat rising costs with an upswing in productivity!

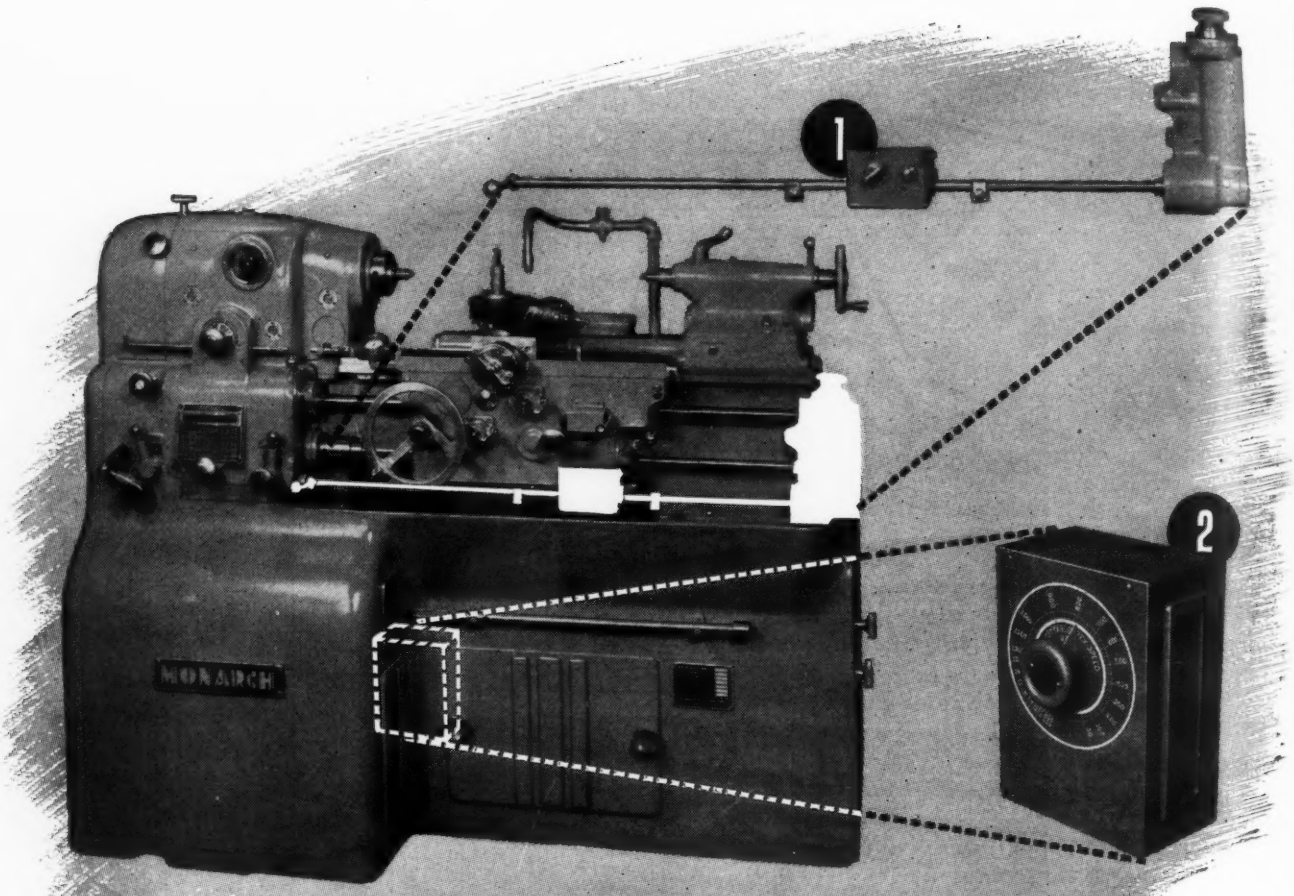

STATION NO. 3
2.57 DIA. DRILL - 10 HOLES A
27/64 DIA. DRILL - 4 HOLES B
.875 REAM - 2 HOLES C
3/4 PIPE TAP - 1 HOLE D
(REAR UNIT)
STATION NO. 2
1/2 DIA. SPOT DRILL
10 HOLES A
1/2 DIA. SPOT DRILL
4 HOLES B
33/64 DIA. DRILL
2 HOLES C
33/64 DIA. DRILL
1 HOLE D
(SIDE UNIT)
STATION NO. 4
5/16-TAP 10 HOLES A
1/2-13 TAP 4 HOLES B
34.500
STATION NO. 1 - LOAD & UNLOAD PART
DIAGRAM SHOWING
LOCATION OF PARTS IN THE FIXTURE



● Here's multi-operation performance that results in high production! This example shows a Baker 36HO Vertical Hydraulic Feed and 7½AA Horizontal Units in combination with Multi-Spindle Tap Unit around power index table for multi-operations at one chucking of part. The work is a gear carrier in malleable iron, handled as shown by blueprints at left.

BAKER BROTHERS-Inc. TOLEDO OHIO

DRILLING - BORING - TAPPING AND KEYSEATING MACHINES



TWO REASONS WHY you can chase threads UP TO 50% FASTER on a MONARCH

1—ELECTRIC LEAD SCREW REVERSE for chasing either external or internal threads. Users have found it particularly valuable for internal threading of blind holes. Its outstanding superiority is the direct result of two features exclusive in the Monarch design. First, work rotation automatically stops at the end of each cut. Second, the mere twist of a convenient knob adapts the mechanism to chase either right or left-hand threads—or makes it inoperative, for greater operator safety when gauging or loading and unloading the workpiece.

With the electric lead screw reverse you'll be able to chase more accurate threads—*and you'll be able to do it faster.* The flip of one lever reverses the entire machine, returning the cutting tool to its starting position for the next cut. You can maintain perfect timing between the tool and the work. Automatic stops are provided in both directions of travel.

2—VARIABLE REVERSE SPEED CONTROL mounted on the rear of the machine gives even greater speed in the operation of the electric lead screw reverse. With this control you can preset the reverse speed of the driving motor to *greatly accelerate* the return of the threading tool for the start of the next cut.

This is an exclusive Monarch feature—one that has enabled users to reduce floor-to-floor times by as much as 50 per cent on the longer threads.

These two exclusive Monarch attachments are typical of the many extras available on the Monarch 10" EE Sensitive Precision Toolmaker's Lathe—features designed to make the base machine exactly suited to your individual work requirements.

Regardless of the nature of your metal-turning needs, Monarch is ready with the latest designs, to give you *peak production at a profit.* May we talk it over?

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

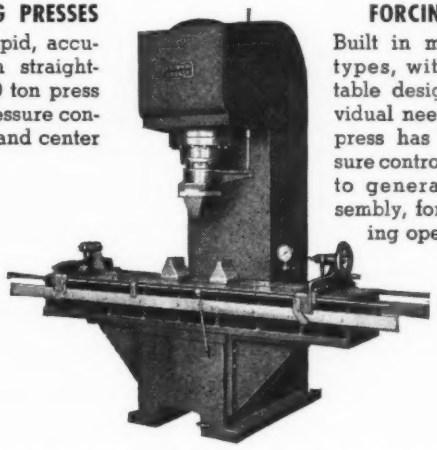
HANNIFIN PNEUMATIC AND HYDRAULIC EQUIPMENT

HYDRAULIC PRESSES

Available in 2, 3, 4 column, and open gap types, capacities 5 tons to 150 tons, for straightening, forming, press assembly, and similar operations involving the application of pressure. Column spacing, ram stroke, table construction, speeds and controls may be readily modified to suit individual needs.

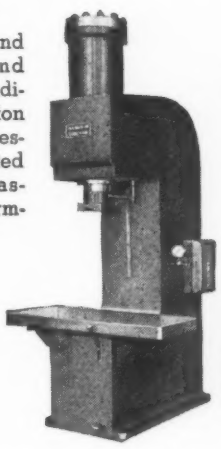
STRAIGHTENING PRESSES

Designed for rapid, accurate production straightening. This 100 ton press has sensitive pressure control, long table and center type fixture.



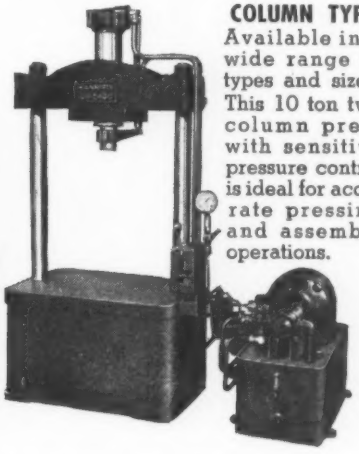
FORCING PRESSES

Built in many sizes and types, with control and table design to suit individual needs. This 75 ton press has sensitive pressure control and is adapted to general press-fit assembly, forcing and forming operations.



COLUMN TYPE

Available in a wide range of types and sizes. This 10 ton two column press with sensitive pressure control is ideal for accurate pressing and assembly operations.

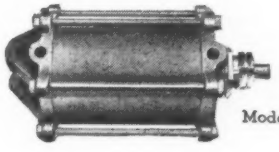


AIR CONTROL VALVES

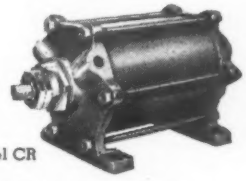
Disc type for positive, accurate control of air operated equipment. Efficient disc type design without packing prevents leakage and waste of air power, does away with packing maintenance troubles. The bronze disc controlling air flow is ground and lapped to make a perfect seal with the valve seat. Made in 3-way and 4-way types for control of single and double acting cylinders in hand or foot models, spring return, heavy duty rotary, manifold, and electric models. Also piston type pressure regulating valves.

PNEUMATIC CYLINDERS

Provide simple outside adjustment of the soft piston packing, allowing easy maintenance of the high efficiency piston seal with minimum friction loss. All sizes are bored and honed for straight, round-mirror finish cylinder bore—a better finish that means better cylinder performance. Built in a full line of standard mountings, sizes 1 to 6 inch bore, for any length stroke, with or without cushion.



Model BR



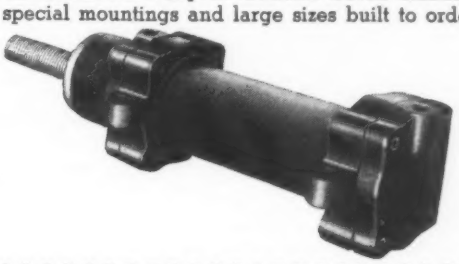
Model CR

"HY-POWER" HYDRAULIC RIVETERS

For high speed production riveting, punching, pressing. Portable and stationary types available, designed for easy handling and consistent rapid production. Capacities 7½ to 100 tons. The automatic operating cycle is push-button controlled and includes rapid advance stroke, automatic high pressure working stroke, automatic reversal, rapid return stroke. The hydraulic pressure generator is a compact motor driven unit. "Hy-Power" equipment is adaptable to a wide range of riveting, punching, and pressing operations.

HYDRAULIC CYLINDERS

With patented "no-tie-rod" design, providing a stronger cylinder assembly, simpler to apply, assuring high efficiency operation. End caps may be positioned independently without disturbing mounting, for simple, efficient piping. Mirror finish honing gives a cylinder bore that is straight, round, perfectly finished. High efficiency piston seal with minimum fluid slip is assured. Seven standard mounting types; special mountings and large sizes built to order.



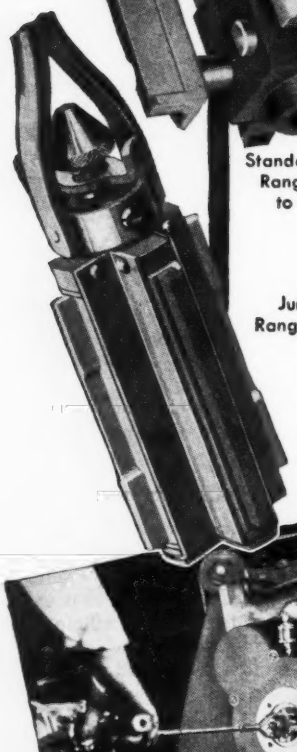
HANNIFIN MANUFACTURING COMPANY • CHICAGO 24, ILLINOIS

On Cylinders from 2" to 14½" in Diameter

SUNNEN Portable Cylinder Hones

Provide Smooth Accurate Internal Finishes

Standard Model
Range 2 11/16" to 14½".



Junior Model
Range 2" to 2.6"

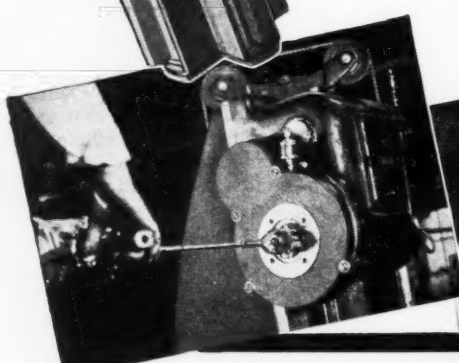
These hones provide a fast, easy, practical, economical way to produce internal finishes that are guaranteed to be accurate within .0005". Straight round holes are produced without disturbing previously established alignment. Sunnen Portable Cylinder Hones produce any commercially required finish with full bearing surface. They correct errors of out-of-round, taper, bell-mouth, wavy condition, distortion—and remove tool marks or other surface imperfections.

With Sunnen Portable Cylinder Hones stock removal is fast. They are portable, can easily be taken to the job. Free floating universal joint permits operating at an angle. Adjustment is simple, easy and positive. Easy to use, can be set up for operation in one minute. Handles any metal or plastic except lead and babbitt.

Sunnen Portable Cylinder Hones are ideal for *Selective Fitting of Mating Parts—Small Lot or Odd Size Production—Salvage and Production Repairs—Maintenance of Operating Equipment.*

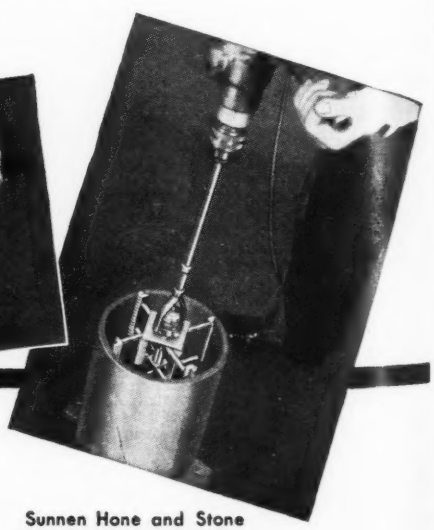
If you have an internal finishing problem, call a Sunnen Engineer —or write for free bulletin, form No. X-AN5001.

SUNNEN



Sunnen Portable Cylinder Hone saved dismantling this machine to install a new boring bar.

Portable End Clamping Fixture enables part to be honed accurately without distortion.



Sunnen Hone and Stone Support handles large diameter cylinders easily.

SUNNEN PRODUCTS COMPANY

7940 Manchester Avenue • St. Louis 17, Missouri

Canadian Factory: Chatham, Ontario

182

NEW

UNIVERSAL DIAMETER GAGE

Another Bryant Postwar Development

The New Bryant Universal Diameter Gage offers faster, simpler and highly accurate inspection of internal or external plain diameters from ⅜ inches to 4 inches — in fact, operation is so simple that after the gage has been set to a master ring, the operator has merely to place a part on the contacts and check accuracy to the nearest .00002 inch on the dial indicator.

Functional design and sound construction result in many labor saving features and assure long lived accuracy in the new gage. The serrated steel work table is adjustable to accommodate parts up to 1½ inches in depth. Diameter measurement is accomplished with three precision-ground, hardened-steel contact points. Two are movable and travel in unison to facilitate setting for different diameters. The third is a stationary sensitive contact which may be operated by a finger-tip control lever when necessary. The points are designed to contact the work at 90 degrees and automatically center it regardless of diameter. To further insure accurate readings, a vibrator actuates the movable mechanism and the dial indicator to disclose very minute variations in the part being checked — this eliminates "feel" for fit.

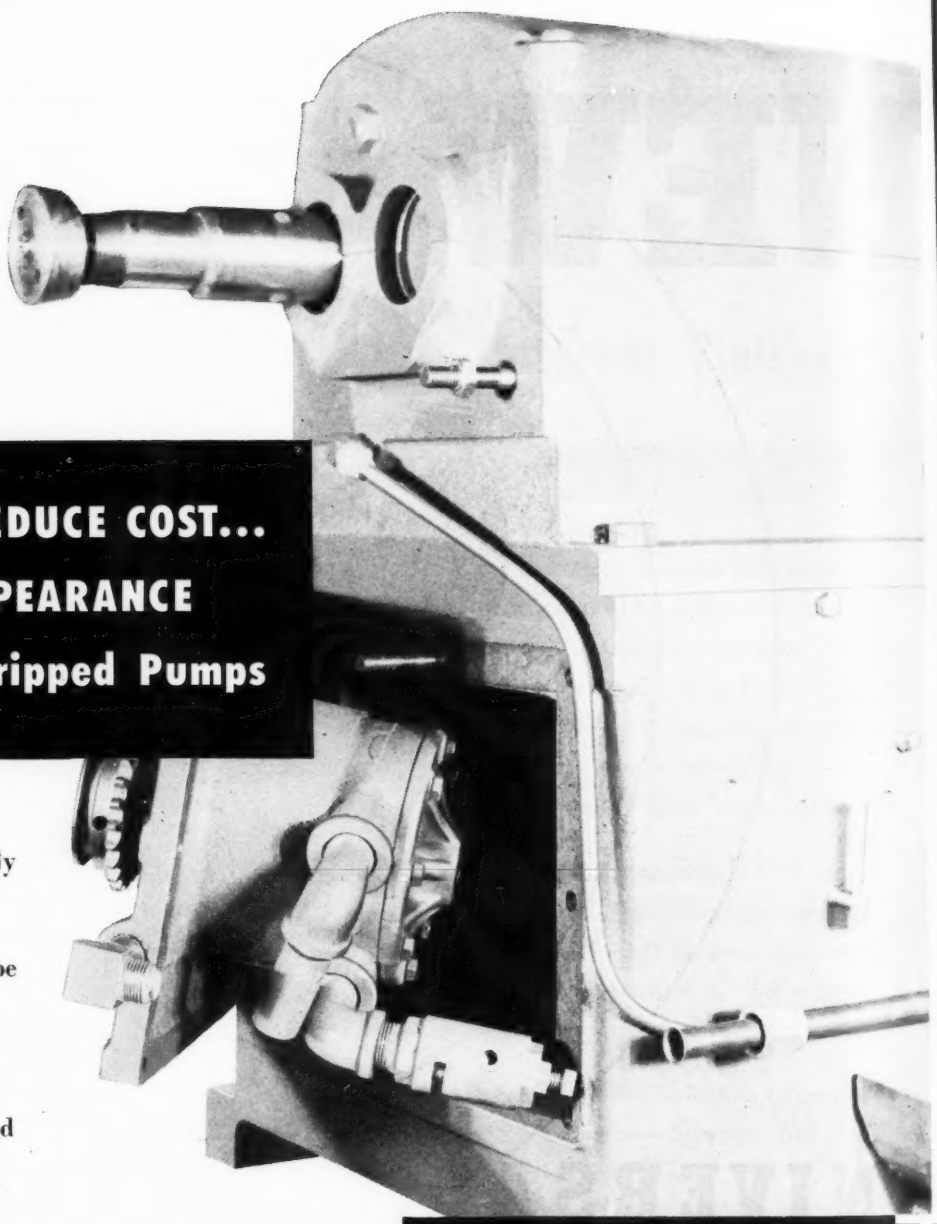
The new Bryant Universal Diameter Gage simplifies and speeds inspection of varying sized plain diameters — cuts quality control costs to a new low — it will pay you to write for complete details.

BRYANT

Also Bench Model Thread Gages, Adjustable Thread Gages, Squareness of Face Gages and Portable Thread Gages.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



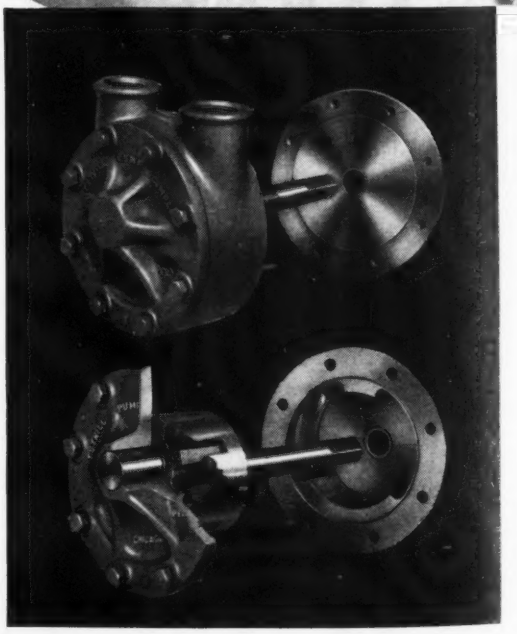
SAVE SPACE...REDUCE COST... IMPROVE APPEARANCE With TUTHILL Stripped Pumps

It pays to build the pump directly into the design of your machine. In this way, valuable space can be saved, appearance improved and costs reduced by minimizing piping, simplifying mountings and permitting more compact design.

To make this possible, Tuthill offers two types of stripped pumps, exclusive with Tuthill: Type S, furnished without the mounting bracket; and Type SA which provides pumping elements only.

One of these types can meet your requirements for lubrication, coolant, hydraulic and liquid transfer service.

WRITE FOR TUTHILL STRIPPED PUMP BULLETIN.

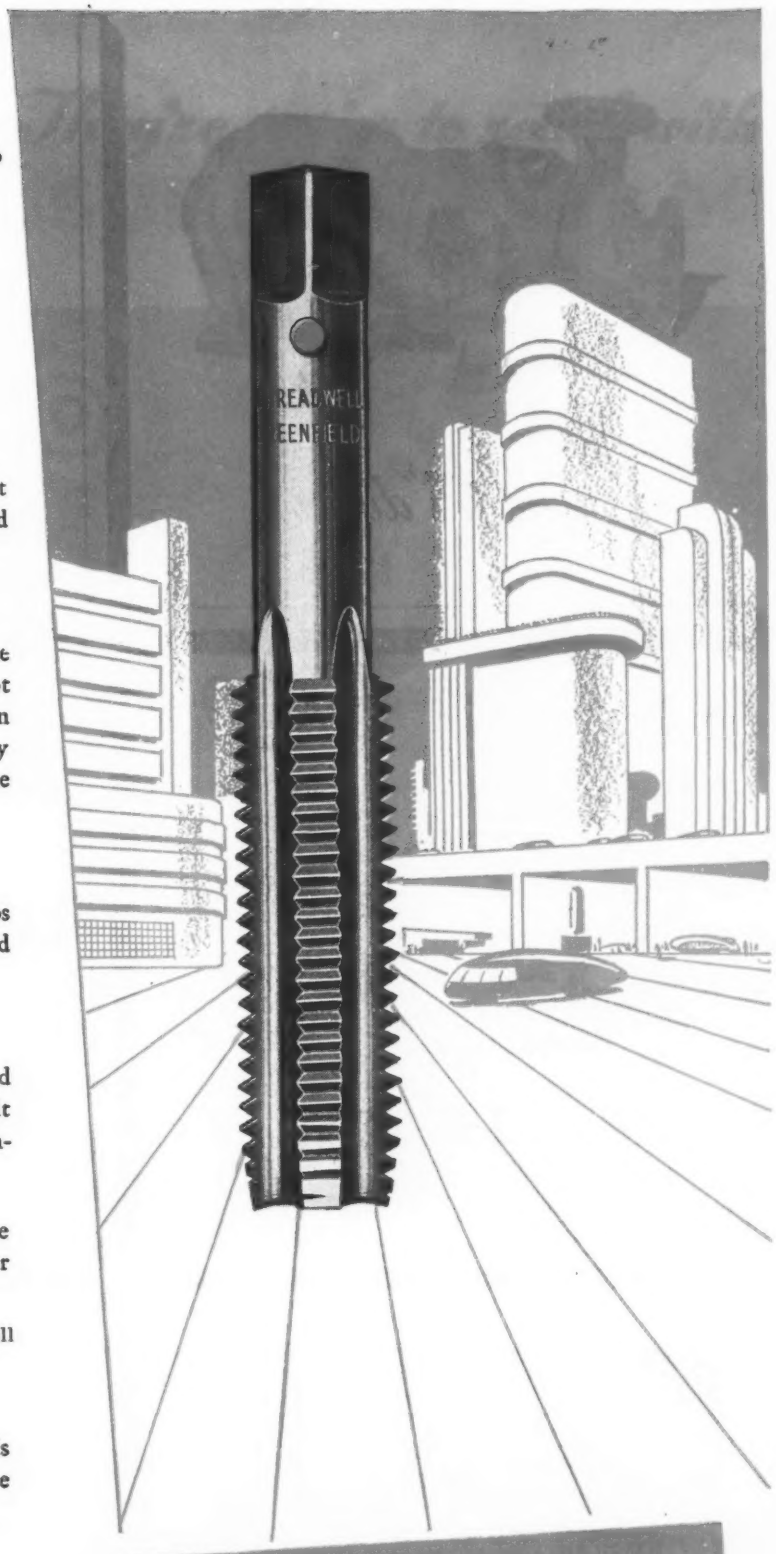


Tuthill Pumps

TUTHILL PUMP COMPANY • 939 EAST 95TH STREET • CHICAGO 19, ILLINOIS

WHY NOT SPECIFY 1947 MODEL TAPS...

Threadwell TAPS



Until *Threadwell* added:

COLD TEMPER deep-freeze treatment at 120° below zero to make high speed taps stronger but less brittle

"*i-dot-ification*" — *red* dot on the shank to identify cut thread, *white* dot on commercial ground, *blue* dot on precision ground — to make it easy for you to select the right tap for the job

Greaseless Rust-Proofing to keep taps always clean, dry and shining instead of messy and sticky to handle

Tap-Capsule to keep each ground thread tap clean and sharp and permit ready selection of type and size without unwrapping

Until *Threadwell* added these performance and convenience features, there hadn't been a change in tap "model" for years.

For up-to-the-minute threading you need Threadwell 1947 Model Taps.

THEY COST NO MORE

The Threadwell distributor in your neighborhood is ready to give you the best modern service, too. May we put you in touch with him?

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT THE UNITED STATES AND THE WORLD

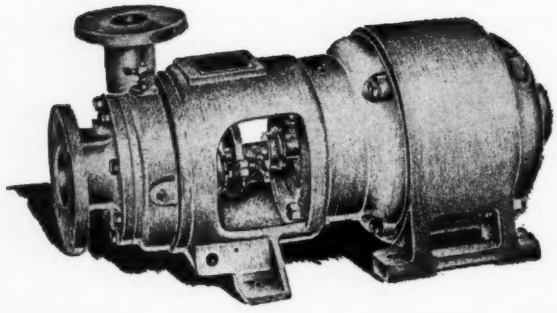
Threadwell

SINCE 1902

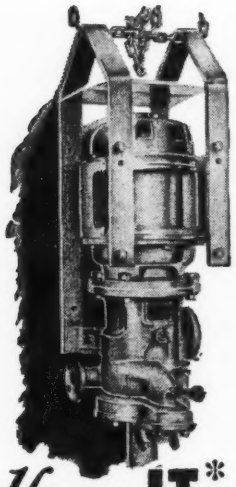
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

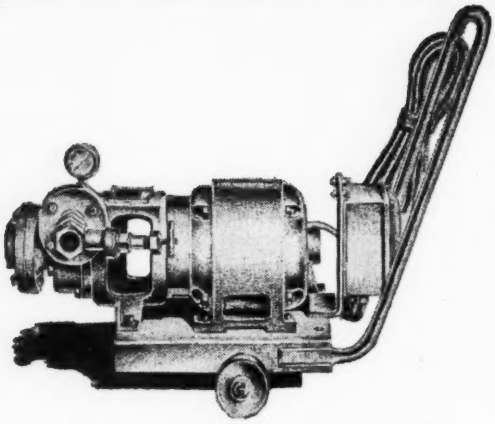
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



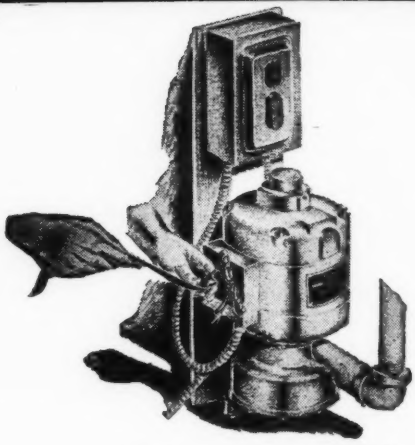
Set **IT*** *down*



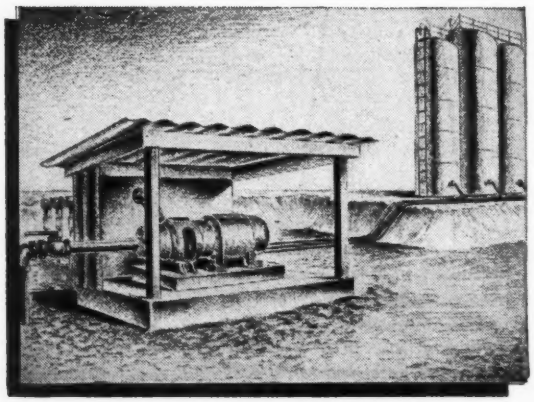
Hang **IT*** *up*



Push **IT*** *around*



Connect **IT***



Leave **IT*** *alone*

IT** is the **MOTORPUMP

the rugged utility unit that works in any position, is at home in any industry, and takes punishment like a seasoned trouper.

➡ Sizes: ½ to 50 hp; 5 to 1800 gpm; 5 to 600 ft head; . . . . Materials to suit your conditions

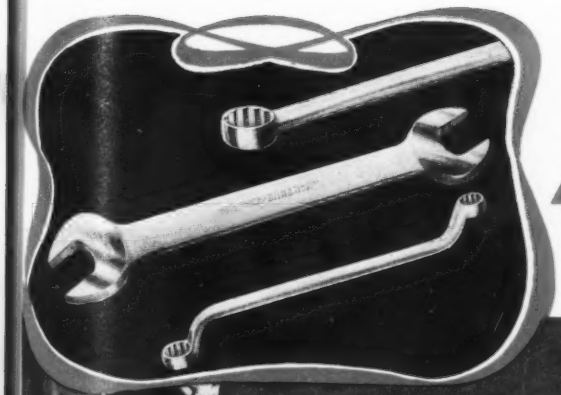
Ask our nearest branch for Form 7093, the Motorpump Catalog.

It's an eye-opener on pump versatility.

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

9-933



They're easier to reach with "SUPERRENCHES"

Awkward, hard-to-reach adjustments present no problem for these slim, taper-jawed "Superrenches". Forged from alloy steel, they are thin enough to operate half nuts yet their strength is equal to that of the strongest wrenches made.

Williams "Superrenches" are available in a wide range of patterns, with openings from 3/16" to 3-1/8". When wartime regulations are lifted they again will be furnished in bright chrome finish. Sold by Industrial Distributors everywhere. J. H. Williams & Co., Buffalo 7, N.Y.

WILLIAMS
DROP-FORGINGS AND DROP-FORGED TOOLS

IT'S THE KNURLING THAT COUNTS

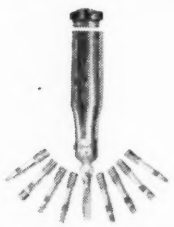
UNBRAKO

Reg. U. S. Pat. Off.

Knurling of Socket Screws originated with "Unbrako" in 1934.

"Unbrako" Self-Locking Socket Set Screw with the KNURLED Point

It's the knurled point of the "Unbrako" Socket Set Screw that digs in and holds tight—regardless of the most chattering vibration. Yet, it can be backed-out and used over and over again. There are millions of these dependable "Unbrako" Self-locking Socket Set Screws with the knurled cup point in use in industry. "Unbrako" and "Hallowell" products are sold entirely through distributors.



You can't screw socket screws in or out, without a hex socket wrench,—so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits. Kits: Pats. Pend.

"Unbrako" Knurled Socket Head Cap Screw

The "Unbrako" Knurled Socket Head Cap Screw has the knurling around the head—right where it gives even the most oily fingers a real slip and fumble-proof grip. This knurling makes it possible to screw the "Unbrako" Head Cap Screw in farther and faster before a wrench is used,—a real time and money saver where production is all important.

The "Unbrako" Catalog contains complete information about the many types of Screw Products carrying the famous "Unbrako" name—get your copy and keep it handy.

Pat'd. & Pats. Pend.

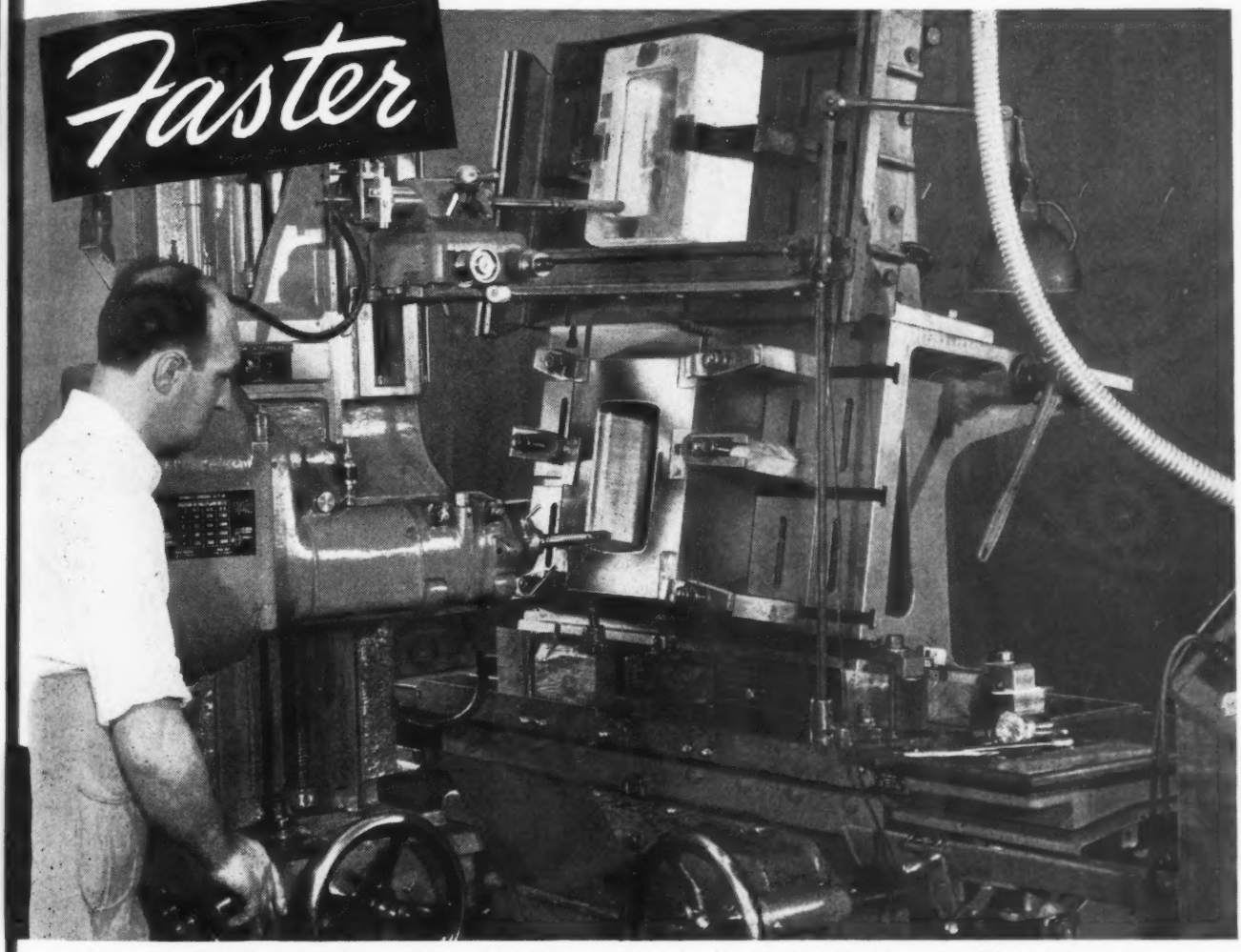
OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

BETTER PLASTIC MOLDS

Faster



The versatile Keller at work on a plastic radio cabinet mold at Sterling Engineering Company, Winsted, Conn.

A plastic product cannot be better than its mold. Production and profit demand not only more accurate molds but speed and economy in their making. All three — economy, speed and accuracy — are supplied by "tracer-controlled milling" of the Pratt & Whitney Keller machine . . .

Many plastic molds require fine detail on side walls or in deep corners, along with minimum draft angles (sometimes only a half degree). By ordinary methods, such detail is difficult and expensive to produce. With the versatile, flexible Keller, there is no such difficulty. As the illustration shows, the fixture which carries the master and the work may be tilted or turned at an angle as needed. This does not change the relationship between master and work, or between tracer and cutter, but it does make the side walls and corners easy to reach. Result — mold designers are free from mechanical limitations in producing complicated cavities.

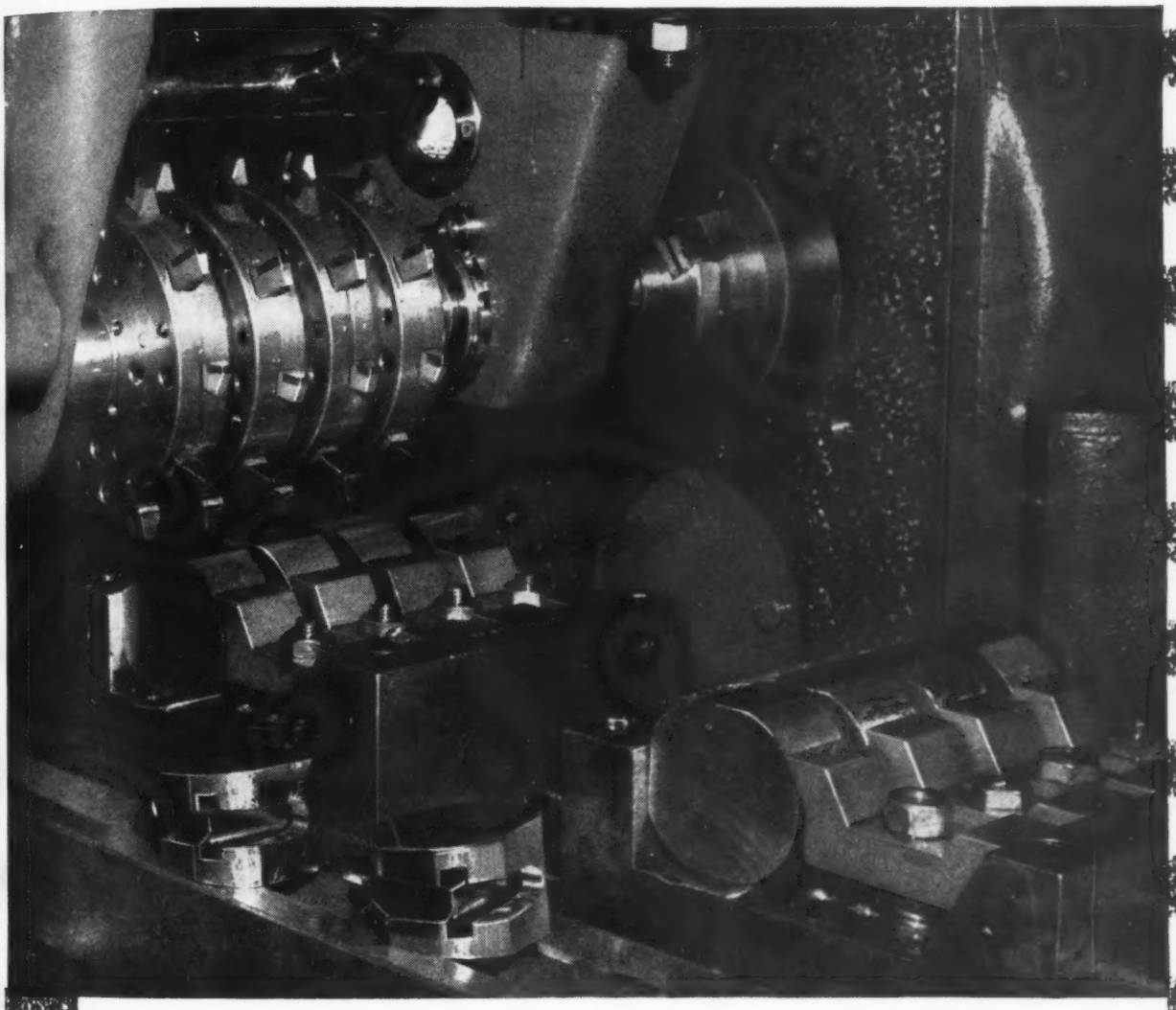
A Keller in your shop will turn out both volume and variety of molds. It guides itself automatically, speeds production — lowers cost. There are Keller machines in sizes and with capacities to meet any requirement. Write today for full information.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

80 pieces per grind
machining
stainless
steel with
FIRTHITE



This unusual operation is being performed by a leading valve manufacturing plant, machining 2¾" round 18-8 stainless steel. Ten Firthite tools are staggered in each of four cutting heads on a milling machine to cut slots ¼" deep x 1¾" long—containing a 60° angle, $^{19}/_{32}$" at the top of the angle.

The remarkably high output (800 pieces per grind) and the excellent results obtained attest again to the advisability of using Firthite sintered carbide tools for most satisfactory cutting performance. What is your problem?

Call Firth Sterling

STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA
PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

You're Cooking on Both Front Burners

(PRODUCTION AND SALES, TOO)

...when you use AMERICAN PHILLIPS SCREWS

IN PRODUCTION: Many top-rank stove builders and other makers of household appliances rate the modern method of American Phillips Screw-driving as a major means of cost-control. For American Phillips Screws save by making power-driving practical on *all* jobs. And they save in many other ways: Fumble-proof starts, automatically straight driving, no burred screwheads or spoiled work, faster assembly . . . and more finished goods on the shipping platform *every day. Sum of all time-savings runs as high as 50%.*

IN SALES PROMOTION: American Phillips Screws give *any* product a smartly finished, modern look that packs plenty of appeal to purchasers. And there are no snags to catch hose or clothes. So American Phillips Screws pay off double...in the plant and on the sales-floor. Ask American to show you how and why *American Phillips Screws always cost least to use.*

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street *Detroit 2:* 502 Stephenson Building

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

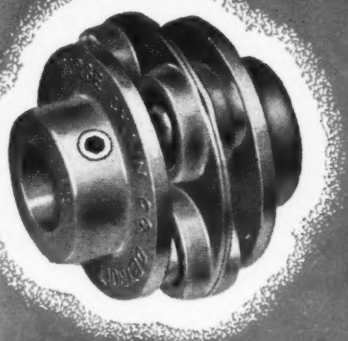
AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

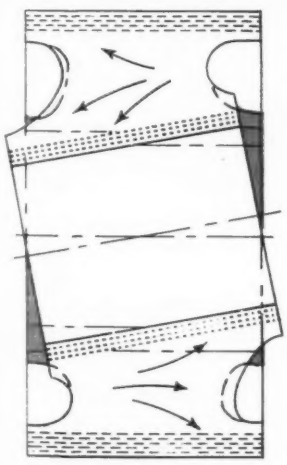
COUPLINGS FOR BIG JOBS . . .

MORFLEX



MORFLEX JUNIOR

and LITTLE JOBS



Specially-shaped Neoprene biscuits, pre-loaded in assembly, distribute uniform stress throughout their volume under all conditions. Arrows indicate deflection as biscuit compensates for angular misalignment of connected shaft.

MORFLEX COUPLINGS

Cushion Shock, Isolate Vibration
Prolong Machine Life

Morflex Couplings, available in 12 sizes of 3 to 725 foot pounds torque capacity, protect big machine installations and fractional horsepower applications alike.

The exclusively Morse-designed Neoprene biscuit assembly permits maximum smooth power delivery, isolates uneven impulses for longer machine life.

Morflex Couplings require no lubrication. They're clean—do not soil products, and are unaffected by oil, dirt or weather.

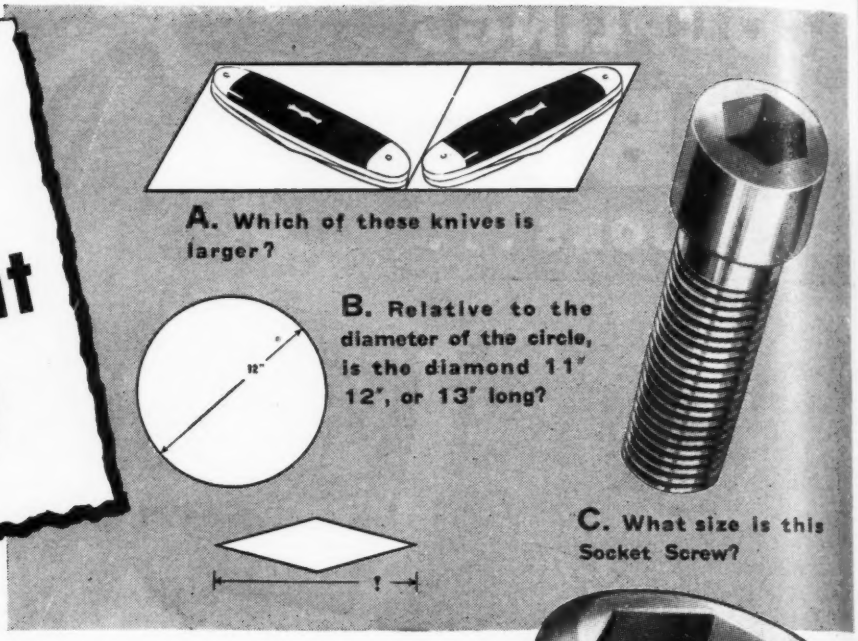
MORSE CHAIN COMPANY • Detroit 8, Michigan • Ithaca, N. Y.

MORSE

MECHANICAL POWER TRANSMISSION PRODUCTS

A PRODUCT OF B-W BORG-WARNER

Can YOU Guess Right on Size?


A. Which of these knives is larger?
B. Relative to the diameter of the circle, is the diamond 11" 12", or 13" long?
C. What size is this Socket Screw?

GUESSING is fun in a game . . . but there's no place for it in shop practice. Wrong guesses cost money . . . and they happen more often than you think. For example, the size and thread pitch of the socket screw above was guessed wrong by many veteran shop men questioned in a recent test. On the job . . . such mistakes waste time.

There's no need to guess...

WHEN IT'S SIZE-MARKED

Just a quick glance at the head of any P-K Cap Screw reveals its size. Clearly incised, easily read, the Size-Mark represents a big forward step in the simplification of assembly operations.

Experienced men like the Size-Mark because it saves their time. Green hands are all for it because it protects them from errors. Tool crib bosses want it because it speeds up the sorting of left-over, mixed-up screws. And the men who service your products will appreciate the Size-Mark because it saves their time on reassembly jobs.

Are you missing this opportunity to aid your assembly workers – to speed up assemblies – and to provide an extra sales feature for your product?

Plus – GEAR GRIP*

Gear Grip on Size-Marked Socket Head Cap Screws is a further aid to fast work . . . makes them slip-proof even when fingers are oily. Write today for samples . . . Parker-Kalon Corp., 202 Varick St., New York 14, N. Y.

ANSWERS:

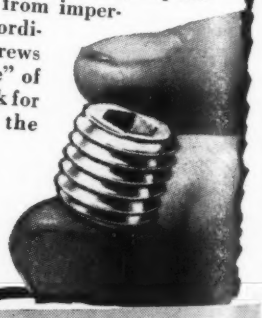
A. Both are the same. **B. The diamond is 13" long.**
C. There's no question when it's P-K Size-Marked!

* U. S. Pat. No. 126,409

ANOTHER **P-K** FIRST

GROUND THREAD
Socket Set Screws

● Smooth, mirror-bright, clean finished threads – centerless ground on hardened blanks. Accurate contour and lead, dependable Class 3 Fit. Free from imperfections common to ordinary cut thread set screws . . . a "shining example" of good workmanship. Ask for samples. You'll see the difference.

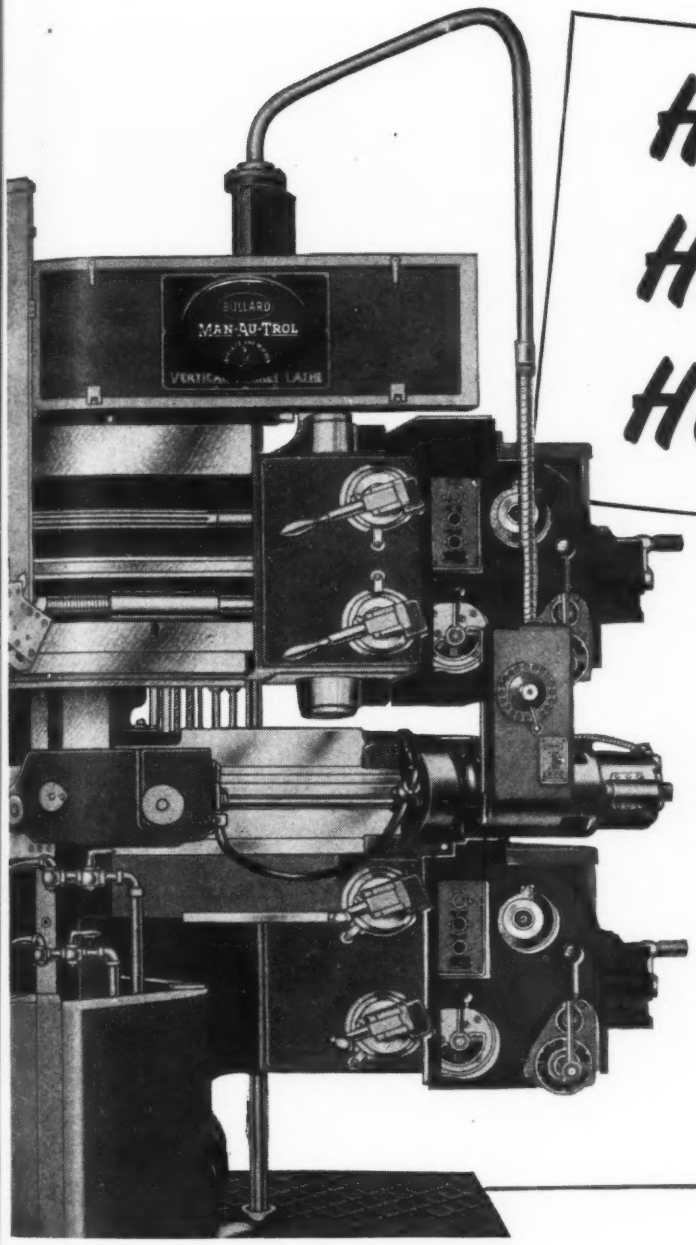


P-K SOCKET SCREWS ARE AVAILABLE FOR PROMPT DELIVERY!

Send for Stock List Now

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS

PARKER-KALON *Cold-forged* SOCKET SCREWS



How Much? How Many? How Soon?

Three questions that production men must answer *right* the first time

How much it will cost to turn out a product or part depends on *how many* units can be produced *how soon!* To keep getting higher production at lower unit cost you must keep your eyes open for *new methods* to increase output per man-hour with less human effort. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD CREATES ***NEW METHODS*** TO MAKE MACHINES DO MORE

For example: **See how the BULLARD MAN-AU-TROL**

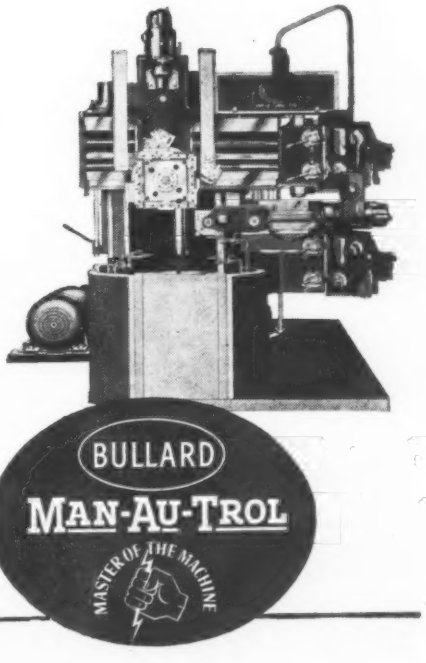
Vertical Turret Lathe lowers unit production costs.

Lightens Labor's Load. Operator machines one piece manually, setting production method into automatic cycle; then merely loads, supervises and unloads while MAN-AU-TROL does the work.

Makes Automaticity Versatile. Automatically handles any work within manually operated scope of Vertical Turret Lathe. Converts instantly to manual operation on same or entirely different piece without affecting automatic cycle.

Saves Set-Up Time. Set-up time from one class of work to another is only slightly more than for a manually operated machine.

Reduces Salvage Cost. Machines day after day with consistent accuracy not obtained under manual operation.

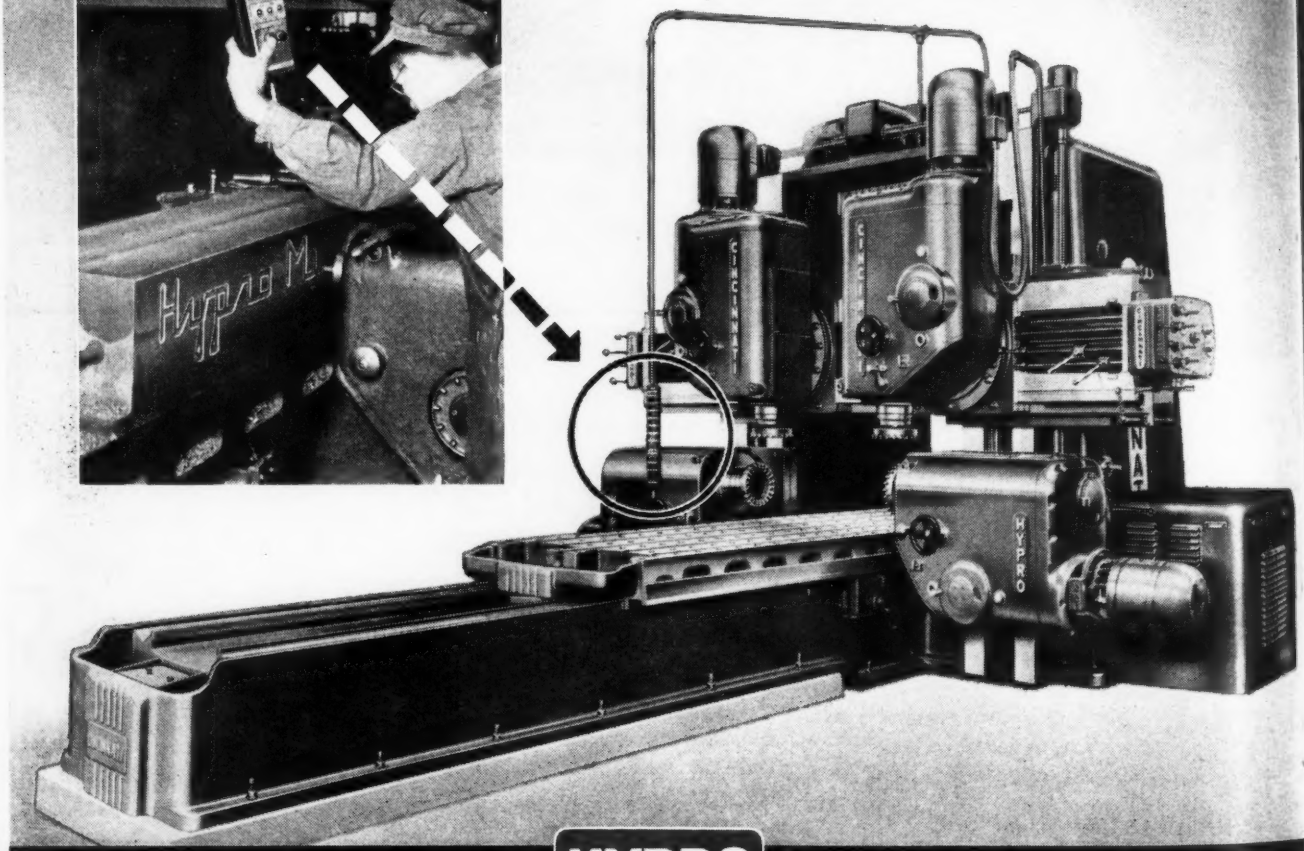


NOW COMPLETE FINGER-TIP CONTROL FROM PENDANT STATION...

Hypro·electronic

PLANER MILLER DRIVE

Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

RULE OUT *Wasted time*

Too narrow a face on a grinding wheel can mean too much time on the job. Why use a wheel with a 1″ face, for instance, when one with a width of 1½″ to 2″ can increase surface contact 25 to 50%? This time saving efficiency is yours in the complete line of Simonds Abrasive wheels. Whether for rough snagging or for precision finishing there is a Simonds wheel to measure up to your most exacting requirements for maximum production with speed and efficiency. A copy of the Simonds Abrasive Data Book is available to guide your selection. Write for yours today.

For assistance in requisitioning consult Simonds Abrasive distributors located in all principal cities.

SIMONDS ABRASIVE COMPANY

PHILADELPHIA

PHILADELPHIA 37, PA.

DISTRIBUTORS IN ALL PRINCIPAL CITIES

FOR HEAVY STOCK REMOVAL

To settle all doubt—

MICROHONING CUTS CHIPS! MICROHONING IS METAL CUTTING!

These Are Microhoned Honing Chips—

Millions—Billions—of such small scale chips are cut by the many thousands of face contacting grits in an average 3 to 6 stone set of honing stones—all cutting at the same time. Combined—they can remove a lot of metal—up to .080″ on diameter—in a relatively short time—or at rate of .006″ to .008″ per minute.

This means that high production now has a new method of short-cutting time cost by honing from the green bore—hardening—and finish honing—with elimination of intermediate bore machining operations.

It is economical in other ways. New additive treatments in Micromatic Honing Stones yield from 200% to 400% more bores per set of stones than was formerly possible.

HONING MACHINES, HONING TOOLS, HONING FIXTURES AND HONING ABRASIVES

MICROMATIC

DISTRICT FIELD OFFICES: 1323 S. Santa Fe, Los Angeles 21, California, Phone: Tucker 3756 • 194 Dalhousie St., Brantford, Ont., Canada, Phone: Brantford 1128 • 616 Empire Bldg., 206 So. Main St., Rockford, Ill., Phone: Forest 1128 • 501 Harries Bldg.

MICROHONING

is the Quicker, Better, Lower Cost Method

For Example:

THIS 4130 STEEL ROCKET TUBE, ROCKWELL 34-38C

Size: 4.220″ diameter x 20.5″ long.
Preceding Operation: Diamond Bore.
Average Stock Removed: .030″ on diameter.
Average Time: 5.45 minutes
Average: 1.5 cubic inch per minute.
Average: .0055″ on diameter per minute.

Another Example:

Aircraft Propeller Blade Tubing

Size: 8.000″ diameter x 96″ long.

Preceding Operation: Drawn Seamless Tubing with scale in bore.

Average Stock Removed: .050″ to .080″ on diameter (approximately 156 cubic inch in bore).

Average Time Required: 65 minutes.

2063

HONE CORPORATION DETROIT 4, MICHIGAN

137 No. Main St., Dayton 2, Ohio, Phone: Hemlock 8261 • 927 A—M & M Bldg., P. O. Box 981, Houston 2, Texas, Phone: Preston 2381 • Room: 514—129 Church St., New Haven 10, Conn., Phone: New Haven 7-0035.

To Answer Your Questions About the New

TWIN DISC

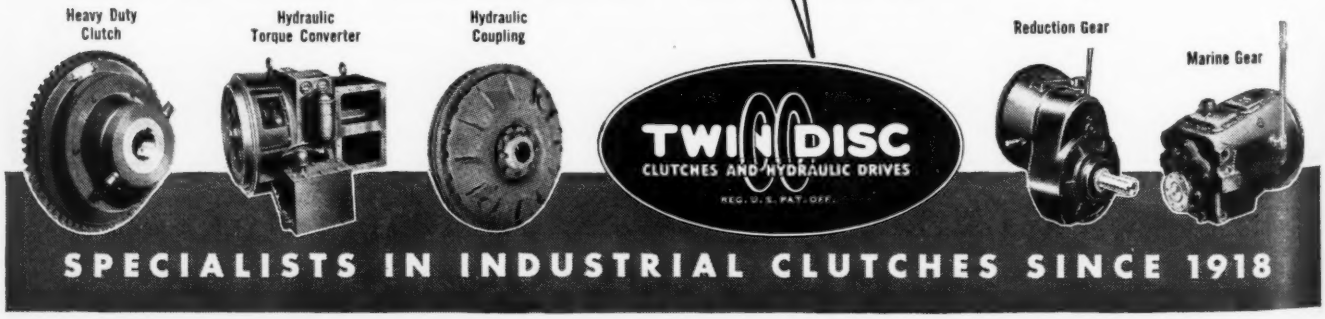
Small Hydraulic Coupling

A new series of Small Hydraulic Couplings for use with one to 25 hp electric motors and internal combustion engines has been introduced by The Twin Disc Clutch Company. You will want to know all about these new couplings . . . how they can solve your particular power transmission problem.

The Small Hydraulic Coupling issue of *Production Road* explains the advantages you can gain by using these couplings . . . smooth operation . . . full torque delivery . . . no stalling. Also, use of this new unit allows the selection of an engine or motor to fit *running* requirements . . . eliminates the need for "break-and-replace" protection for driven parts.

Read how the new series already has been put to use by the Link Belt Company in its "Electrofluid Drive," a packaged power unit.

Write to the Twin Disc Clutch Company, Racine, Wisconsin, for your copy of the Small Hydraulic Coupling issue of *Production Road*. It will answer your questions about the new Twin Disc Small Hydraulic Couplings . . . will tell you how you can put to use their *proved* advantages. THE TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

CUTS SCREW DRIVING COST 50%

THIS manufacturer of vacuum cleaners formerly used Yankee screw drivers for assembly operations. He called in the Rotor Application Engineer to find out if the output per man could be improved. By installing Rotor M-851, 1000 R.P.M. midget air screw drivers, they got these results:

Twice the output per man. These air tools, weighing only 2 lbs., put zip into the assembly. With one hand, the operator drives screws twice as fast as before.

A better job. Equipped with the X-11 Double Adjustable Clutch, these Rotor tools drive screws uniformly to any desired tension.

The Rotor Application Engineer will gladly apply his tool know-how to the cutting of *your* costs. Ask for copy of Bul. 30.

Yours for faster production,

AIR O'TOOL

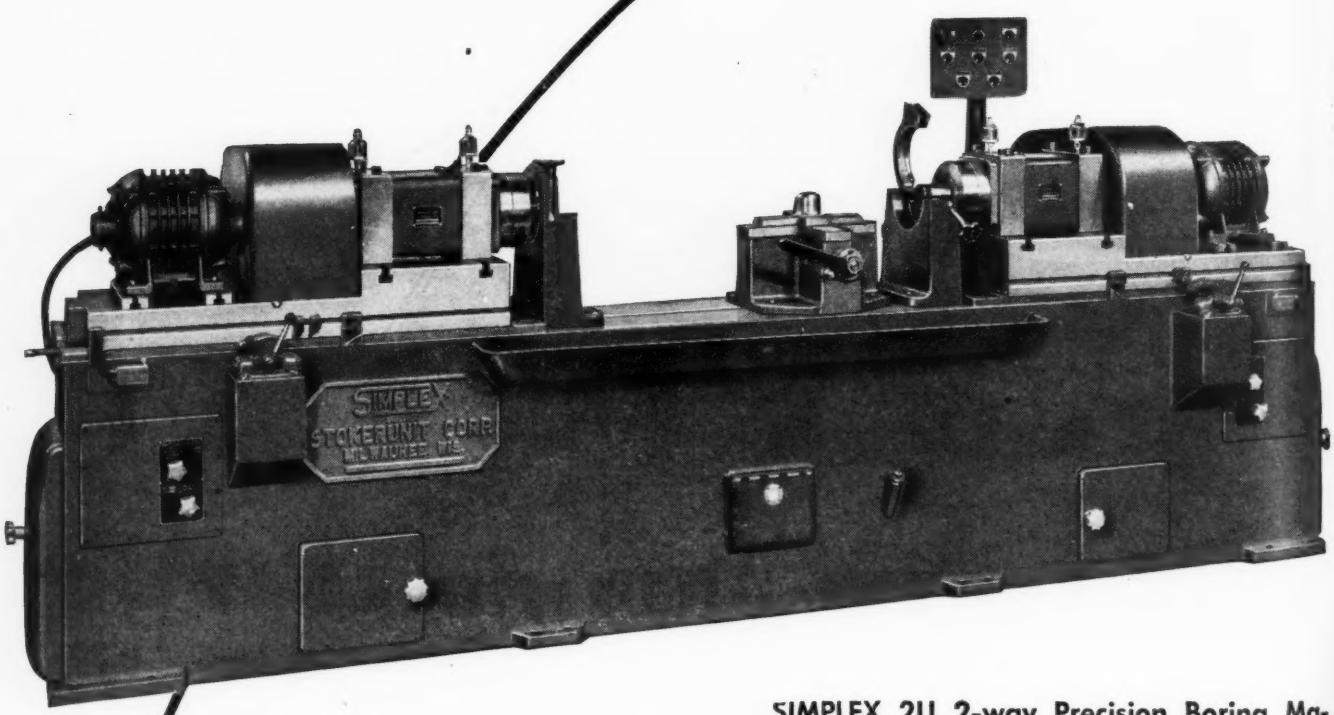
THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

SIMPLEX

A troublesome operation is the boring and turning of concentric cylindrical surfaces on bulky objects, rear axle housings, landing gear parts, etc. Equipment that will perform several operations at one setting of the work reduce these to their simplest form and provide low-cost production with high quality.



SIMPLEX 2U 2-way Precision Boring Machine with #4 spindles and extended bed center section mounting a fixture designed to handle varying lengths of work units, resulted in high production rates for moderate quantities, greater convenience for the operator, and a uniformly high standard of quality.

Precision Boring Machines

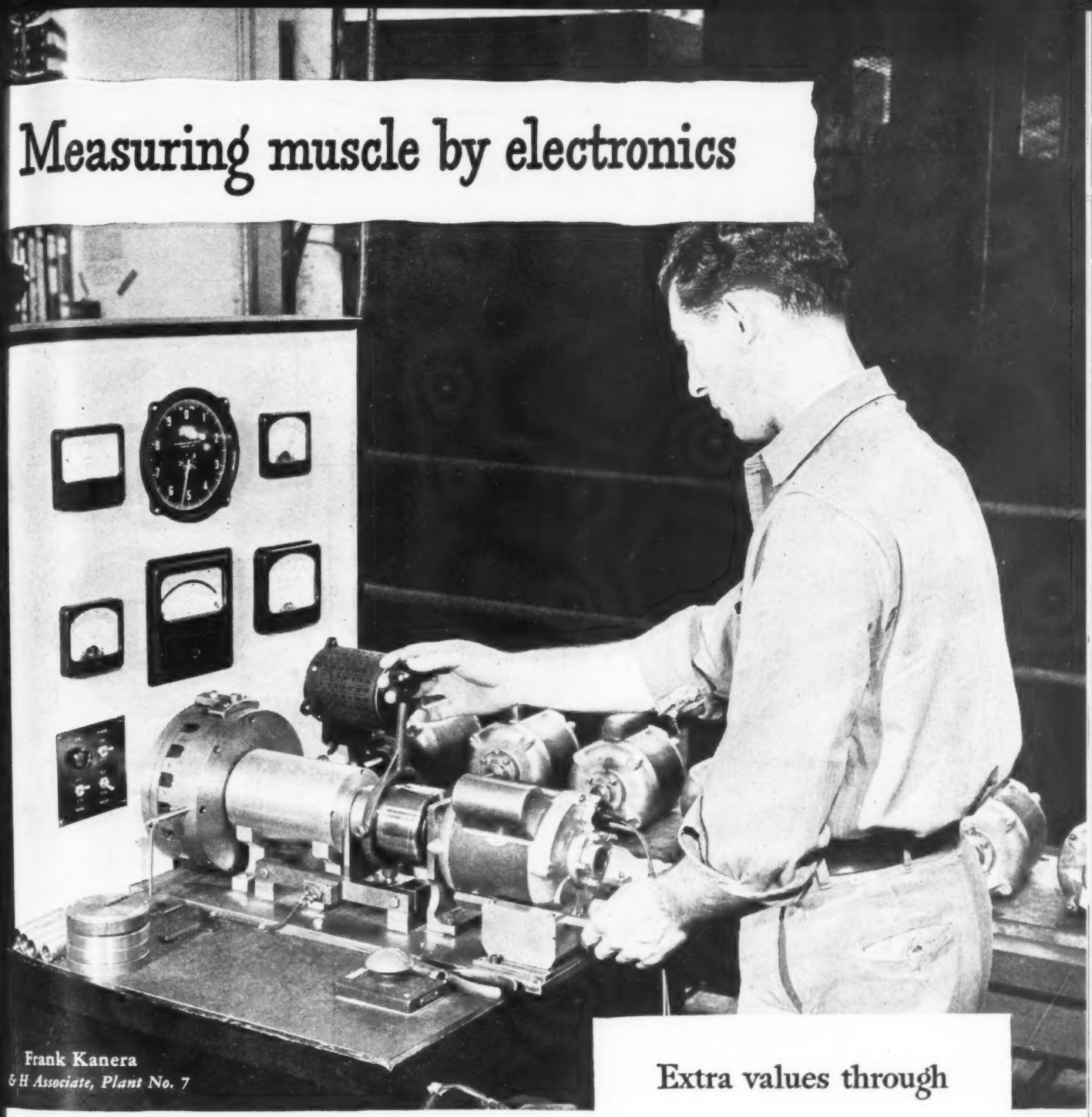
STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4532 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

Measuring muscle by electronics



Frank Kanera
J & H Associate, Plant No. 7

Extra values through

JACK & HEINTZ

Mass Precision

The usual way to measure the torque of electric motors is to use an apparatus of wheels, brakes and weighing scales. This method was too slow and cumbersome for the new Jack & Heintz Fractional Horsepower Motor Plant. So Jack & Heintz Production Engineers developed an ingenious electronic dynamometer which measures motor torques *in a few seconds* with unheard-of precision. An operator simply plugs in the motor and reads the torque on a dial. This helps speed up the production of Jack & Heintz motors for urgently needed appliances.

This is typical of the achievements of Jack & Heintz *mass precision* which are producing extra values in motors, refrigeration compressors, aircraft accessories, Eisemann magnetos and bearings *today*, and which promise startling developments for *tomorrow*.

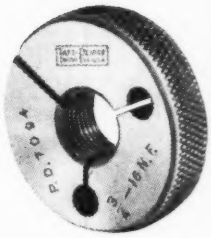
JACK & HEINTZ PRECISION INDUSTRIES, INC., *Cleveland 1, Ohio*

FOR ANY TYPE OF

Thread Gaging...

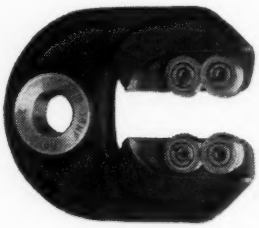
TAFT-PEIRCE

Has the Gage You Need

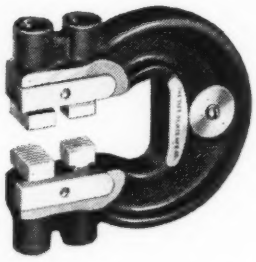


Style 9424—Thread Ring Gage

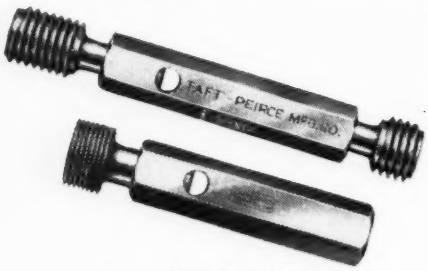
Style 9416—Thread Plug Gage



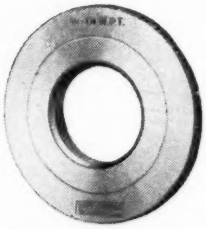
Style 9435—Roll Thread Snap Gage



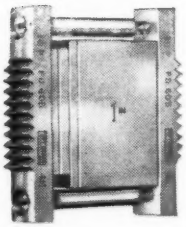
Style 9432—Thread Snap Gage



Style 9420—Thread Setting Plug Gage
Style 9474—Pipe Plug Gage



Style 9475—Pipe Ring Gage



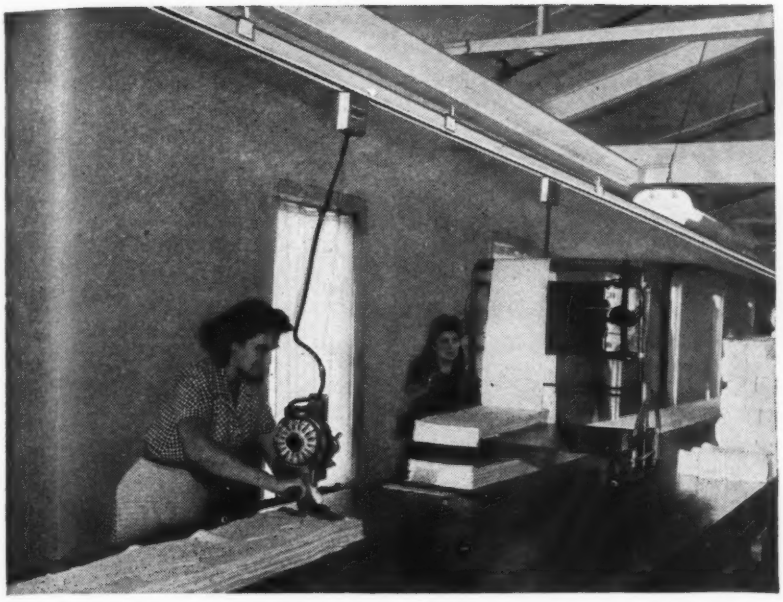
Style 9431—Thread Setting Blocks

The exceptionally complete line of Taft-Peirce Thread Gages includes: Single and double-end limit plug gages (steel or cemented carbide) together with thread-setting plugs and thread-setting blocks. Pipe thread gages, ring thread gages, adjustable snap gages, and roll thread snap gages. Also many special types of thread-gages, and thread measuring wires.

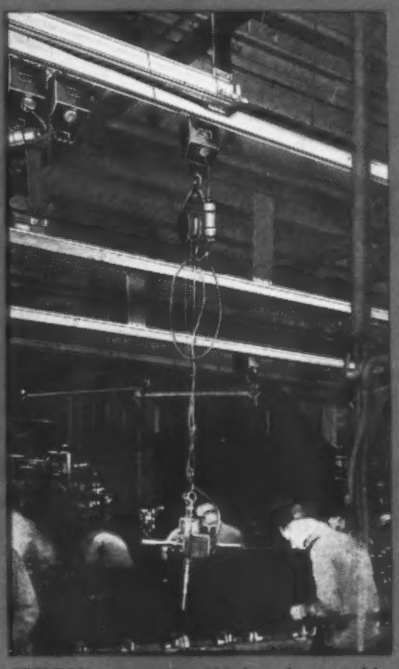
Check your thread-gage requirements against this complete line now available in all types from one of the world's greatest and longest-experienced gage makers. Write to:

The Taft-Peirce Mfg. Co., Woonsocket, R. I.

Use Taft-Peirce Gages for Every Gaging Need



FEEDRAIL used for cutting machine and moving cloth laying machine with inspection light.



FEEDRAIL supporting high-cycle portable tool and balancer in machine shop

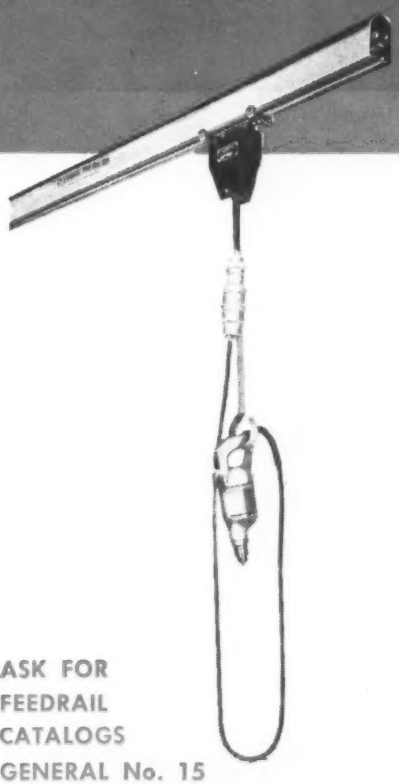
KEEP TOOLS AND CABLES OFF THE FLOOR *with* ELECTRIC FEEDRAIL

FEEDRAIL is an enclosed electric busway system that supports and feeds portable tools. Heavy duty FEEDRAIL trolleys may be equipped with counterbalances to help support the tools. A dead-front fuse block on each trolley or EVER-LOK connectors provides individual protection for high cycle or universal tools.

All electrical contacts are enclosed, and protected from mechanical injury and dust and the system is grounded. Each section carries the Underwriters' Label.

Keeps cables and tools off the floor — no accidental disconnection — no delay — and safety everywhere.

FEEDRAIL is ideal for modernization of any plant that requires production changes from time to time. Also for moving test lines, monorails, cranes and hoists.



ASK FOR
FEEDRAIL
CATALOGS
GENERAL No. 15
NEEDLE TRADES No. 16
MACHINE TOOL No. 17

13

ELECTRIC FEEDRAIL

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company

125 BARCLAY STREET • NEW YORK 7, N. Y.

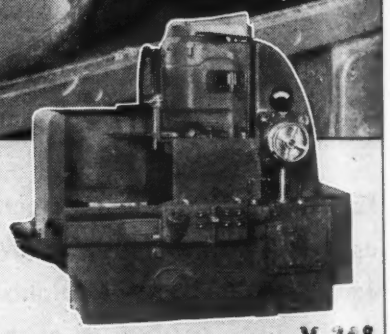
"Put it on the Blanchard"

These are cast iron gear case housings being ground on a No. 18 Blanchard Surface Grinder—another demonstration of increased production of large work over former method.

They are held on a 42" magnetic chuck, three pieces per load, and 1/8" to 3/16" of stock is removed from the surface.

Production is at the rate of 8 to 9 per hour, a substantial increase over the former method of machining when only 2 were produced per hour.

When flat surfaces are required to provide oil-tight joints, "put it on the Blanchard" and also get increased production.



Get These Advantages...

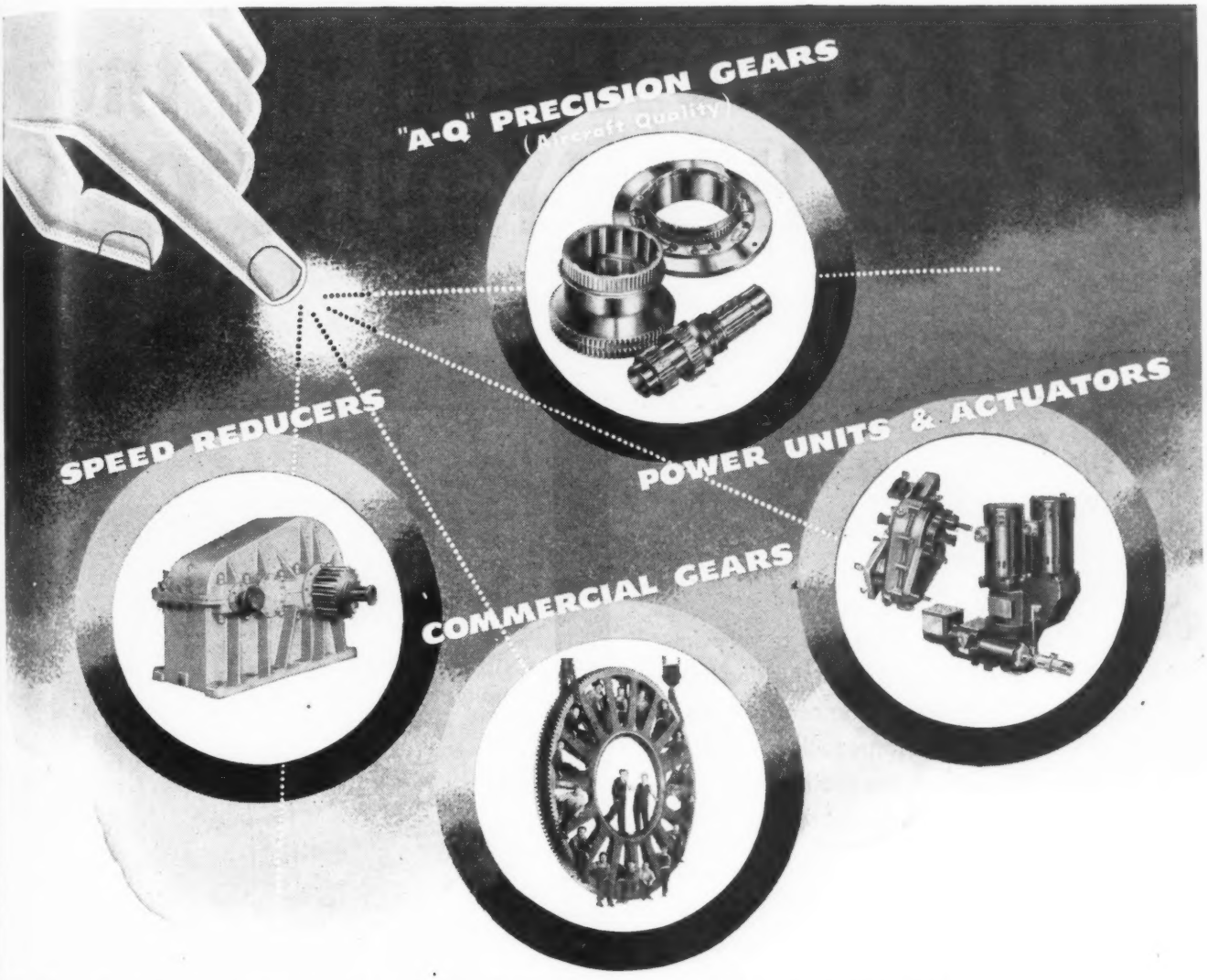
PRODUCTION ✓
ADAPTABILITY ✓
FIXTURE SAVING
OPERATION SAVING
MATERIAL SAVING
CLOSE LIMITS
FINE FINISH
FLATNESS ✓

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



Whatever your needs in power transmission . . .

Regardless of what your requirements in power transmission may be, Foote Bros. has the engineering staff—the skilled production force—the modern plant facilities—to serve you. And above all, nearly a century of experience in producing such equipment.

Today two large plants—one devoted to the manufacture of precision gears, power units and actuators; the other to the manufacture of industrial gears, speed reducers and special machinery—are serving industry. These facilities include research laboratories, a skilled engineering department and a unique heat-treating department providing absolute control so essential to modern gear production.

Whether it's "A-Q" (aircraft quality) Gears of extreme precision that offer light weight, compactness, high efficiency, capable of excessively high speed; or

—Power Units and Actuators engineered to fit your requirements—assuring the accurate mounting so essential to "A-Q" Gears; or

—Speed Reducers in a wide range of sizes and ratios to meet practically every industrial need; or

—Commercial Gears designed to fit your requirements and manufactured in quantities—any size from giants 20 feet in diameter to midgets you can hold in one hand;

—Foote Bros. engineers and Foote Bros. plant facilities are ready to meet your needs.

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 South Western Boulevard • Chicago 9, Illinois

Two engineering bulletins, one on "A-Q" gears, the other on Power Units, offer many suggestions on new developments in application of power. If you have not received copies, mail the coupon below.

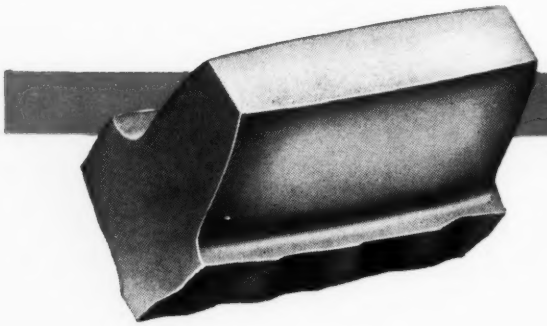
FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR
AND MACHINE CORPORATION
Dept. P, 4545 S. Western Blvd., Chicago 9, Ill.
Gentlemen: Please send me Bulletins on:
☐ Power Units ☐ Aircraft Quality Gears

Name .....
Firm .....
Address .....
City ..... *State* .....

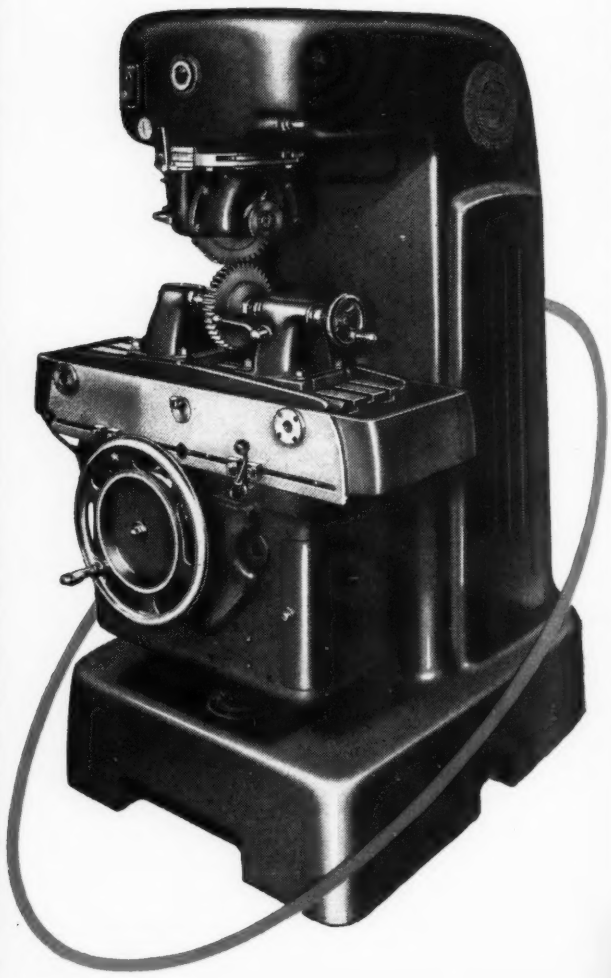
ELLIPTOID TEETH for the Modern HEAVY DUTY GEAR



The Elliptoid tooth form has a very important function. It confines operating load concentrations to the strong central region of the tooth and prevents such concentrations at the ends of the tooth where it is weakest and therefore most vulnerable to failure.

The actual difference in tooth thickness between the ends and center of an Elliptoid tooth need be very little (.0003" to .0005" per inch of face) but when that difference is consistently maintained the tooth always develops its maximum operating strength.

The Elliptoid tooth form is developed on Red Ring Rotary Shaving Machines which, in addition, correct errors in tooth spacing, helical angle, profile, eccentricity and surface finish.



NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN — RED RING ○ PRODUCTS — DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK

WIDE-RANGE ADAPTABILITY AND UNUSUAL TOOLING POSSIBILITIES OF THE *Model* **LR** *Lo-swing* DEMONSTRATED ON TRANSMISSION GEAR JOB

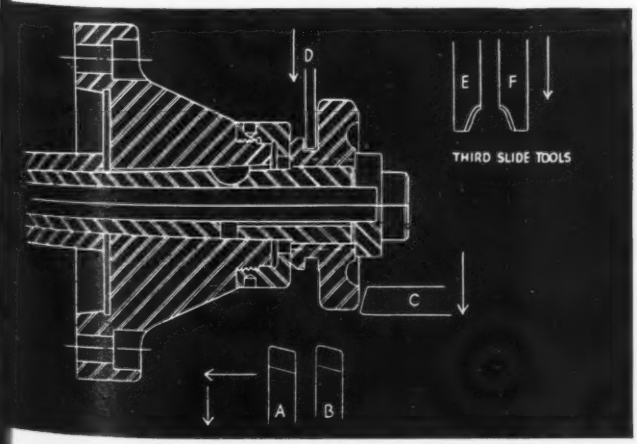
PROBLEM: To rough and finish turn O. D., face, groove and round edges of a transmission gear in a single operation.

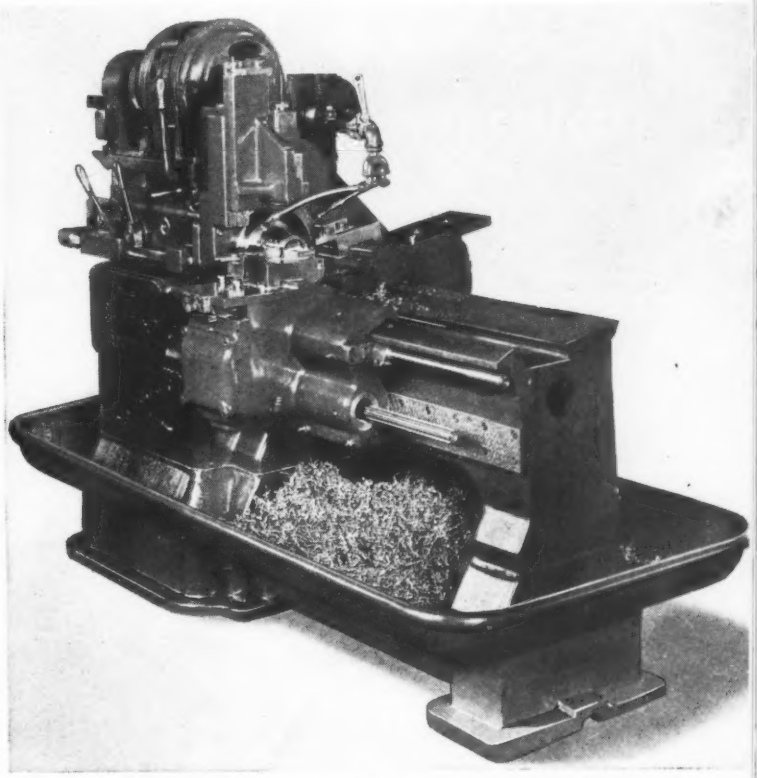
SOLUTION: The work comes to the machine with the bore and back face finished. It is then placed on a stub arbor and held by a draw bar and a "C" washer. As the automatic cycle begins, the front carriage moves longitudinally and tools "A" and "B" (see tool layout below) rough and finish turn the O. D. of the gear. As the front slide moves out, tool "C" faces the outside surface. Simultaneously with the above operations, tool "D" on the back squaring attachment machines the groove, and tools "E" and "F", mounted on the vertical third slide, form the corners of the gear body.

All tools are tipped with carbide, assuring maximum production at high spindle speeds and a first class finish. Simplicity of tooling is also an important feature where many different sizes of gear blanks are to be machined.

Another important feature of this lathe is the Simplified Change-over Mechanism which makes changing from one job to another as simple as setting a tool.

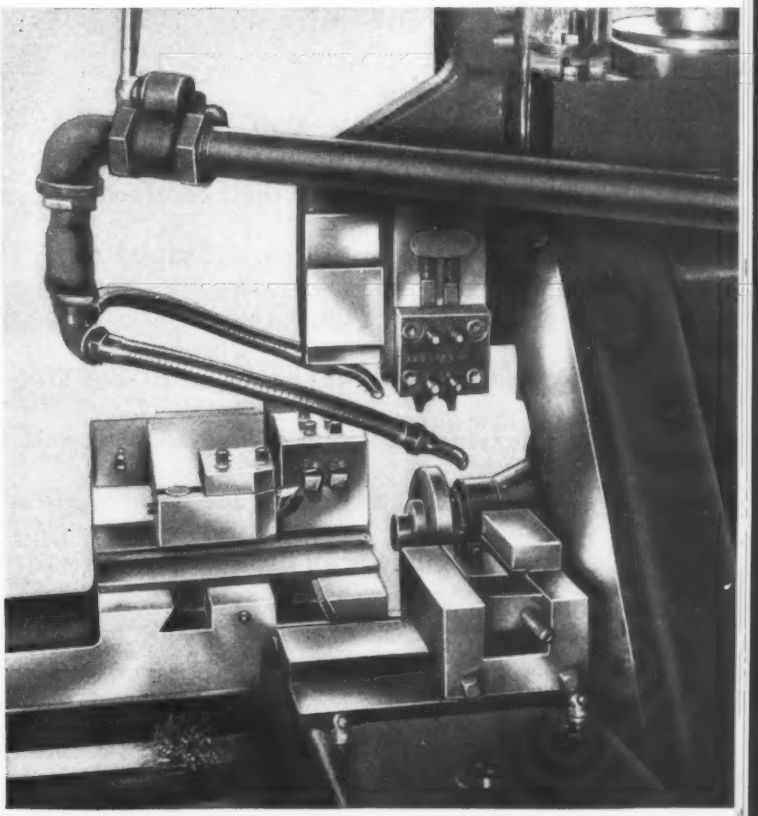
Catalogs and full information furnished on request.



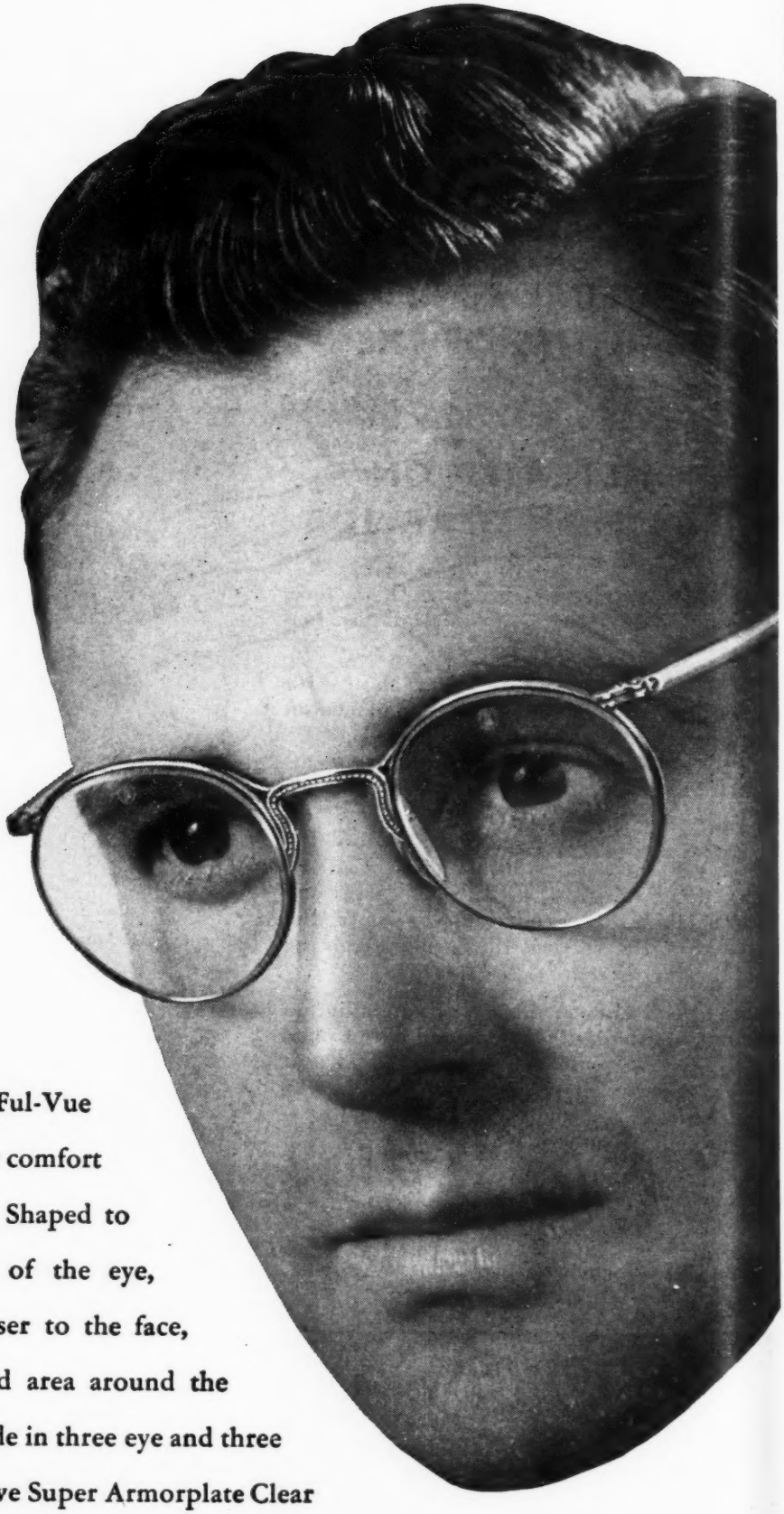


Above: Model LR Lo-swing Lathe equipped with Third Arm.

Below: Close-up view from rear of machine showing tooling for the gear job described.



LATHE NEWS from SENECA FALLS



Ful-Vue
Safety Goggles
for Good Looking
Eye Protection

Workers like A-O Ful-Vue Safety Goggles for their comfort and good appearance. Shaped to conform to the orbit of the eye, lenses are brought closer to the face, leaving no unprotected area around the bridge of the nose. Made in three eye and three bridge sizes, with 6-curve Super Armorplate Clear or Calobar lenses—with or without side shields. The nearest A-O Safety Representative can supply you.

American Optical Company — Safety Division

SOUTHBRIDGE, MASSACHUSETTS. OFFICES IN PRINCIPAL CITIES

Knock-Out EXPANDING MANDRELS

They're fast! They're accurate! They're economical!

CAN BE PURCHASED SINGLY OR IN SETS

MODEL NO.	CAPACITY	MODEL NO.	CAPACITY
M0	3/8" to 1/2"	M36	1 3/32" to 1 1/16"
M1	1/2" to 11/16"	M45	1 1/16" to 2 1/32"
M2	11/16" to 1"	M46	2 1/32" to 2 1/2"
M3	1" to 1 1/16"	M5B	2 1/2" to 3 1/4"
M4	1 1/16" to 2 1/2"	M5C	3 1/4" to 4"
M25	11/16" to 27/32"	M55	3 1/4" to 4 3/4"
M26	27/32" to 1"	M6B	4" to 4 3/4"
M35	1" to 1 3/32"	M6C	4 3/4" to 5 1/2"
		M7	2 1/2" to 5 1/2"

IF IT'S MADE BY LEE IT'S A *Knock-Out*

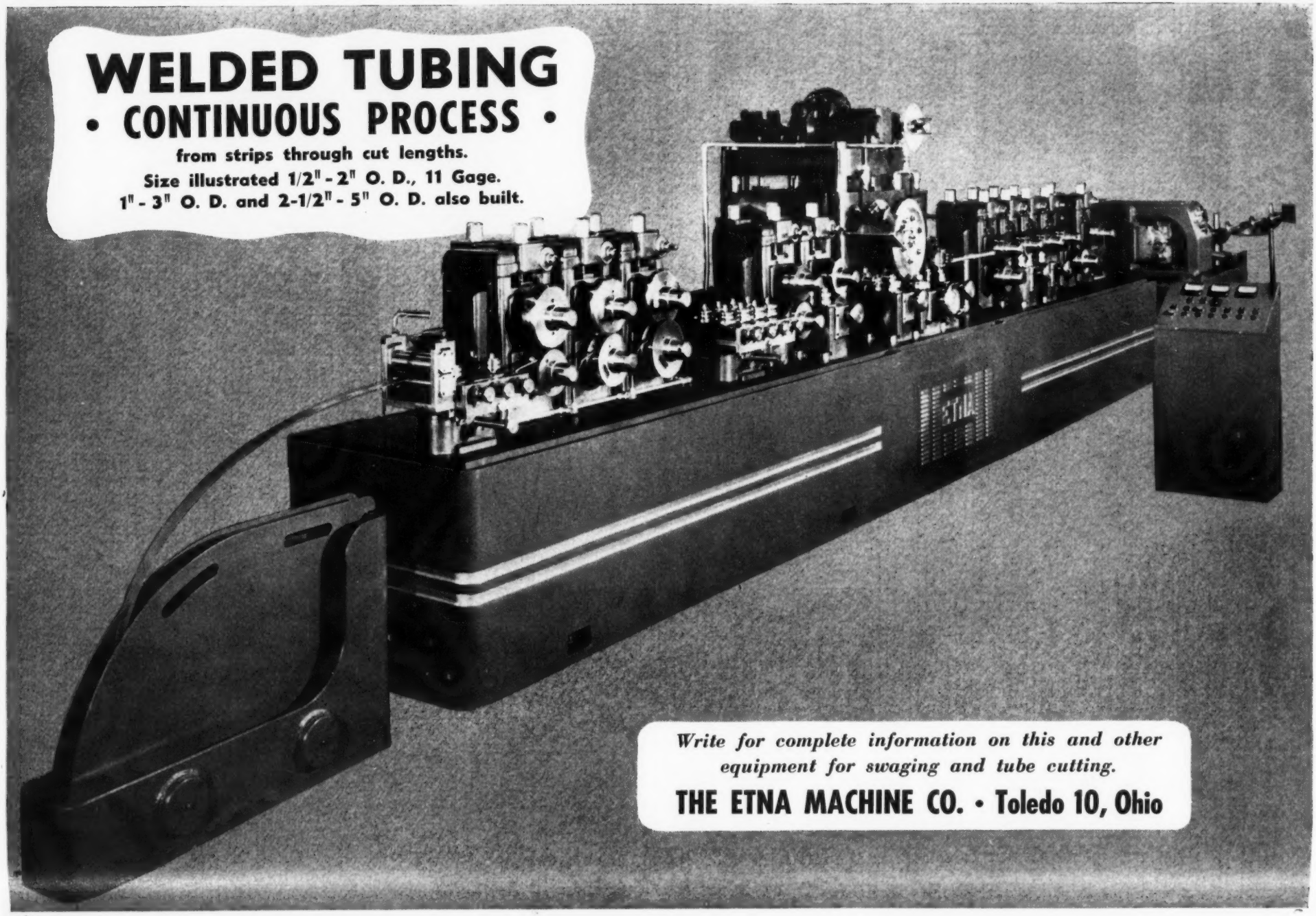
SEE YOUR NEAREST DISTRIBUTOR OR WRITE TO K. O. LEE CO.

1130 1st AVE. S. E., ABERDEEN, SO. DAK.

WELDED TUBING
• CONTINUOUS PROCESS •

from strips through cut lengths.

Size illustrated 1/2" - 2" O. D., 11 Gage.
1" - 3" O. D. and 2-1/2" - 5" O. D. also built.



Write for complete information on this and other equipment for swaging and tube cutting.

THE ETNA MACHINE CO. • Toledo 10, Ohio

3.6 seconds

TAPPING TIME: ~~12.5~~ SECONDS

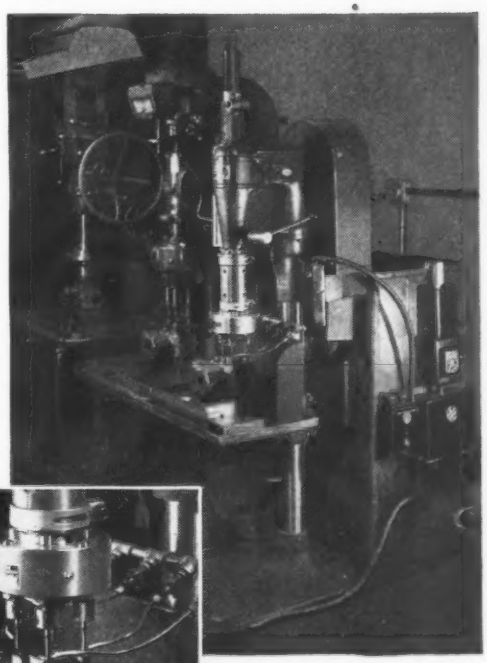
Cylinder castings of Briggs & Stratton air-cooled gasoline engines have four 5/16" 24 thread tapped holes on one side. Tapping the four holes individually required 12.5 seconds plus 12 seconds loading and unloading time.

Today, all four holes are tapped simultaneously on a Cleveland Lead Screw Tapping machine with a multiple tapping head on a 3.6 second tapping cycle. Allowing the same loading and unloading period, total time has been reduced from 24.5 seconds to 15.6 seconds — and there are no "missed" holes.

Cleveland's positive lead-screw feed, operator-controlled coolant system and rigid spindle design not only make this important saving possible but also produce better threads, eliminate scrapped castings and cut tap breakage to a new low.

This is one of the many instances in which Cleveland's greater precision, high efficiency and accurate depth control is helping manufacturers meet today's higher costs.

There is every possibility Cleveland engineers can point the way to equally important savings on your drilling and tapping jobs. For their recommendations, send your prints and specifications or sample parts to The Cleveland Tapping Machine Company, Hartville, Ohio, U.S.A.



Write **FOR A COPY OF "THE PRODUCTION TAPPING GUIDE"**

CLEVELAND
lead screw
tapping machines

HYDRAULIC DEEP DRAWING

WITH AN AUTOMATIC ALL OIL-HYDRAULIC DOUBLE ACTION PRESS

250/90 TON SELF-CONTAINED OIL-HYDRAULIC DOUBLE ACTION DEEP DRAWING PRESS

SUPPLIED TO THE ALUMINUM COMPANY OF CANADA LTD.

EASILY ADAPTABLE TO SINGLE ACTION OPERATION

FOR DEEP DRAWING

OF VESSELS WITH DIFFERENT DEPTHS AND SHAPES

OF LIGHT METALS AND STAINLESS STEEL

WITH HIGHEST ADJUSTABILITY OF SPEED AND PRESSURE EASILY ACCESSIBLE QUICK SETTING OF DIES

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BY MEANS OF LIMIT SWITCHES

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ASSURED BY DEPTH OF SLIDE GUIDANCE

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FOR DRAWING VESSELS OF UNEVEN CONTOUR

AUTOMATIC—DETACHABLE—EJECTOR

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THE NEW LOVEJOY "CUTSALL"

Catalog Describing Tool-Bit Type Carboloy-Tipped Milling Cutters

Here is a brand new Lovejoy catalog filled with facts about Lovejoy's great new Cutsall Face and Step milling cutters. They are designed to profitably meet the most modern production demands. They have such features as interchangeable Carboloy tipped blades, rugged forged steel housings, provision for fine blade adjustment and secure blade locking. And in action they remove metal faster and cleaner than anything you've ever tried. It will pay you to fill in the coupon and mail it to Lovejoy today.

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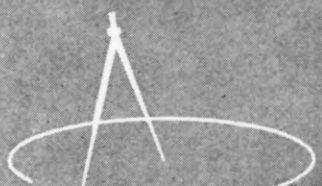
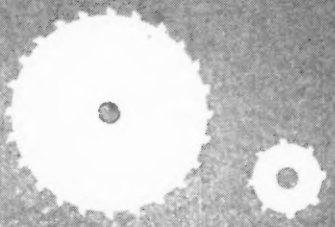
SPRINGFIELD, VERMONT, U. S. A.



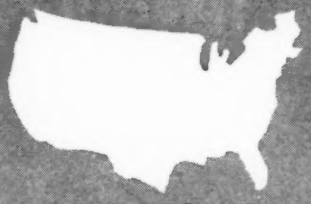
DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.



RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.



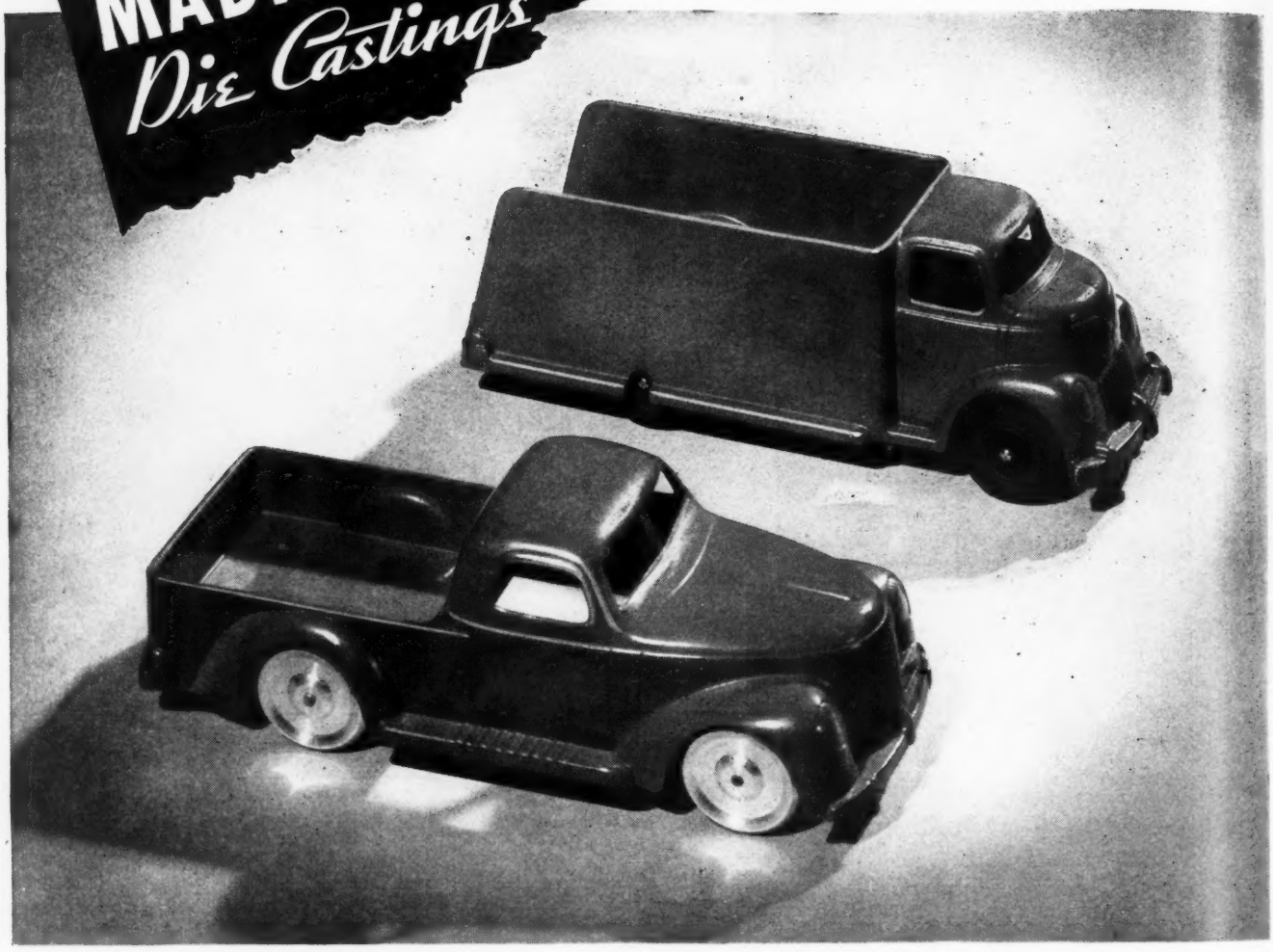
SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

MADISON-KIPP *Die Castings*



ALUMINUM TOYS BY THE MILLIONS

The superior craftsmanship found in the die casting industry is reflected in many other industries.

Take toys as an example—aluminum "Slik" toys in particular. The thin section casting technique developed for making Aluminum Ordnance components during the war period was adapted to casting thin-sectioned "Slik" toys.

There is now a whole series of "Slik" toys with exceptional sales appeal. They are strong and light and manufactured in extremely large quantities.

The advantages of die casting are usually pronounced, whether for toys or for intricate instrument cases, for large or for small parts required in large quantities.

MADISON-KIPP CORPORATION

203 WAUBESA STREET, MADISON 4, WISCONSIN, U. S. A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

BETTER DIES and better DIE CASTING

Reed-Prentice 12-V Universal Head Vertical Miller and Die Sinker.

Number 1½ Die Casting Machine for Zinc, Tin or Lead Base Alloys.

Good die casting requires good equipment, not only for making the die itself but also for the casting of the material. The Reed-Prentice 12-V, an entirely new concept in milling and die sinking machines, has a place in every shop where dies for die casting are made. Its wide range and great versatility provide accurate work with a minimum of set-up time. Infinitely variable feeds and speeds combined with a universal head make it "tops" for die sinking, drilling and boring from all angles.

To utilize dies to the best advantage, Reed-Prentice recommends its line of die casting machines: —the 1½ model for the casting of zinc, tin or lead base alloys; the 1½G and the 3G for aluminum, magnesium or brass alloys. All Reed-Prentice die casting machines are characterized by accuracy of controls — temperature control . . . timers . . . pressure on material . . . pressure on plunger . . . and locking pressure of die plates.

Full specifications concerning milling machines or die casting machines will be sent upon request.

ALSO MANUFACTURERS OF A COMPLETE LINE OF PLASTIC INJECTION MOULDING MACHINES.

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Millers and Die Sinkers ☐ Die Casting Machines ☐

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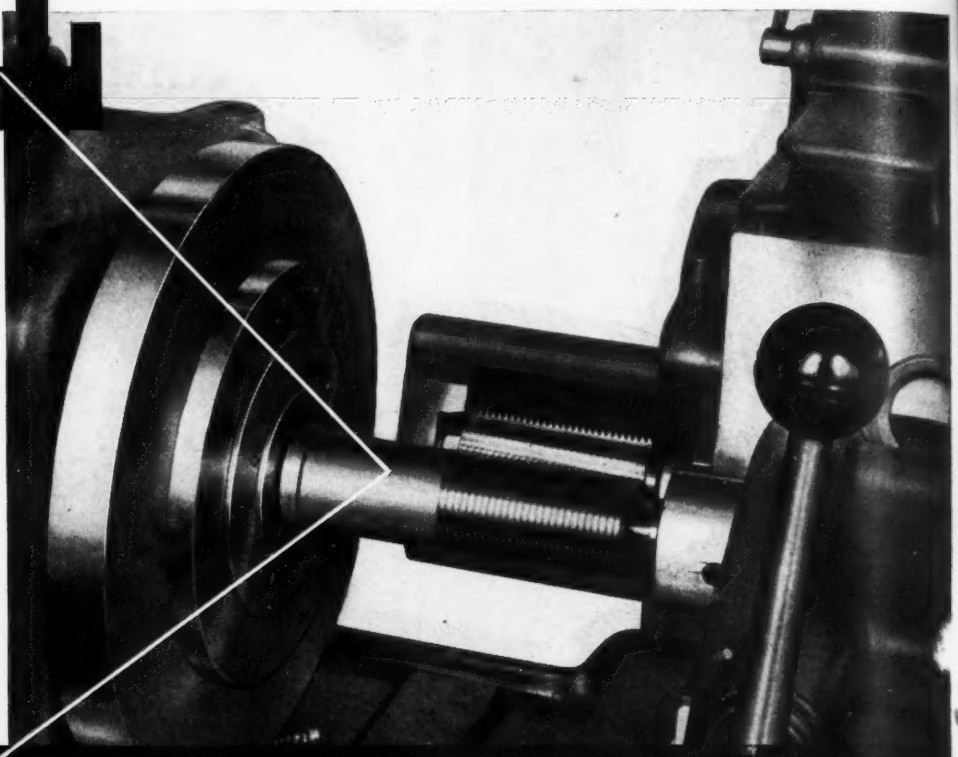
NEW YORK OFFICE:
75 West St., New York 6, N. Y.

CLEVELAND OFFICE:
1213 W 3rd St., Cleveland 13, Ohio

ONE REVOLUTION IS ENOUGH



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In these days of rising costs, Hanson-Whitney is leading the way to more economical thread production . . . to simplified set-up and operation . . . with the very latest thread milling equipment. Internal or external threads; right or left hand threads; straight or tapered threads are produced automatically in one revolution with a multiple thread milling cutter. That means more volume in a given time . . . less time on a given job. Whether you handle small lot or mass production jobs, Hanson-Whitney engineers can show you how to realize direct savings from lower equipment costs, from reduced maintenance, and from lower labor costs. For further information, write: The Hanson-Whitney Machine Company, Hartford, Conn.

Hand it to **Hanson-Whitney**

MACHINE COMPANY

HARTFORD • CONNECTICUT

DANLY

Gap-Frame Presses

1 RUGGED CONSTRUCTION

All-steel, Danlyweld Construction. Intermediate continuous structural members extend up through the back of the frame, reducing deflection throughout the entire length of the bed.

2 MECHANICAL ACCURACY

2 Suspension Points—Eccentric Gear Drive —Extra-long, fully adjustable gibs.

3 PRESSURE OIL SPRAY LUBRICATION

All gears and internal moving parts lubricated in a spray of filtered oil.

4 AIR-FRICTION CLUTCH

Solenoid controlled—provides smooth and fast engagement and disengagement of driving machinery without delay for cam rotation.

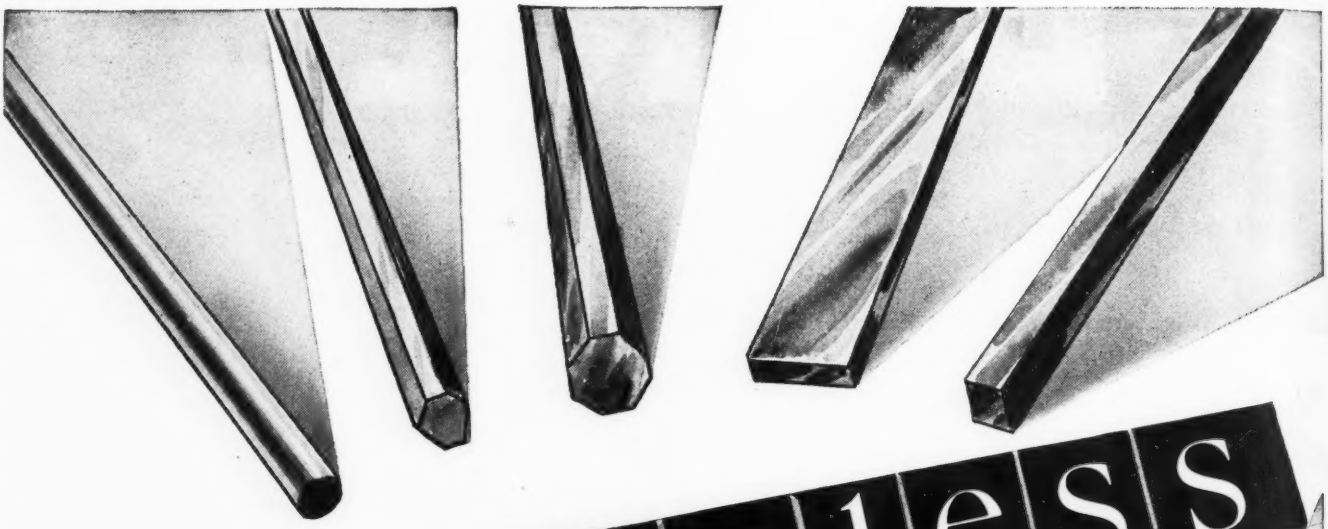
5 MODERN DESIGN FEATURES

Electric Stroke Indicator and Push-button Control Panel—Motor-Driven Stroke Adjustment are standard equipment on this model.

The 250 ton, 2 point Eccentric Gear Gap-Frame Press shown is of all-steel Danlyweld construction. Gearing and driving members are completely enclosed within the frame. This press has a 14" stroke—operates at 20 strokes per minute. Bed area is 32"x84". Shut height—54".

THE PRESS for MODERN PRODUCTION

DANLY MACHINE SPECIALTIES, INC., 2100 South 52nd Avenue Chicago 50, Illinois



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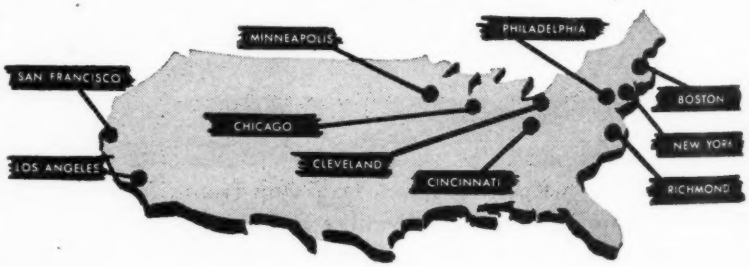
ONLY 10c PER POUND

FOR TOP QUALITY BARS AND PLATES IN PRODUCTION-RUN QUANTITIES

Think of it! Here's the steel you need *now*—priced far below mill prices. Warehouses must be cleared quickly for other surplus. Hence this amazing bargain today.

At this price you can afford to stockpile even against next year's requirements—for these savings will pay storage and interest charges over a long, long time.

Order today from any War Assets Regional Office. But for quickest delivery and less risk of disappointment, order from these offices which have the stock on hand:



types available:

302, 303, 304, 347, 416, 420, 431, 440. Rounds, hexagons, octagons, flats, squares.

Also fair quantities of stainless steel tubing at about 50% discount from net mill prices f.o.b. location.

★ ★ ★

Orders not accepted for less than 5000 lbs., except where the inventory of any individual item is less.

The material offered is subject to withdrawal prior to shipment.

RESERVE FOR PRIORITY CLAIMANTS—This material is offered for sale in the following sequence as provided by law: (1) Certified Veterans of World War II; (2) Subsequent priority claimants in proper sequence; (3) Non-priority purchasers. Federal agencies have had opportunity to fulfill their needs. Veterans of World War II should apply to their nearest War Assets Administration certifying office for certification. The case number shown on the certification, the date of the certificate, and the location of the certifying office must be stated in a veteran's offer to purchase.

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157-10

This RED BADGE of Merit

IS WELL-EARNED BY ALL PRODUCTS THAT WEAR IT

This "ribbon-etch" marks the products made by the longest-experienced manufacturer of cutting tools. And this mark means these 4 things:

1. It means that the product is made of special steel, usually from Simonds' own modern electric steel mills.

2. It means that the product is fabricated in the world's first windowless plant, where all working conditions are constantly controlled to keep workers' well-being and product-quality at top level.

3. It means that the product has been tested and re-tested to make sure you get full Simonds quality in every order. (There's no "second grade" in this line.)

4. It means that the product is represented, *to you,* by Simonds cutting-tool engineers... and by distributors and dealers . . . whose engineering judgment and sales counsel is as sound as the product itself.

And wherever this mark appears in *your* operations, *it will mark a deep cut in your cutting costs.*

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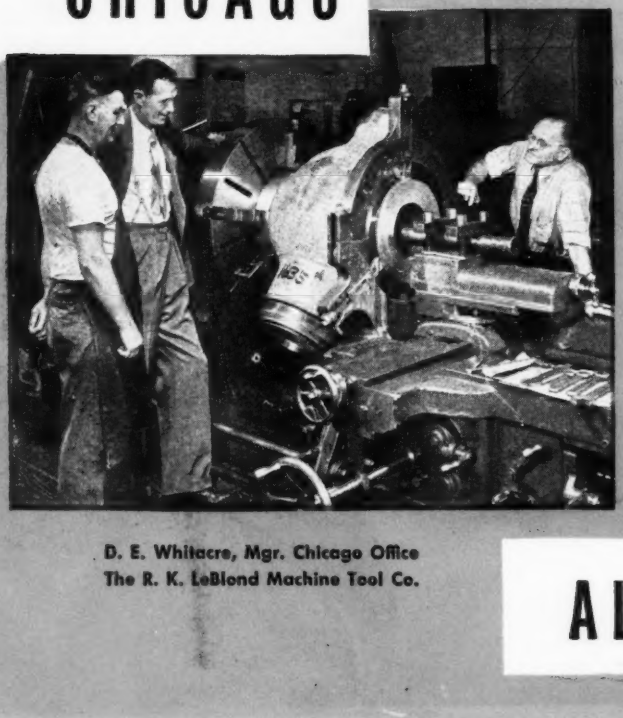
Industry's Story in...

CHICAGO



D. E. Whitacre, Mgr. Chicago Office
The R. K. LeBlond Machine Tool Co.

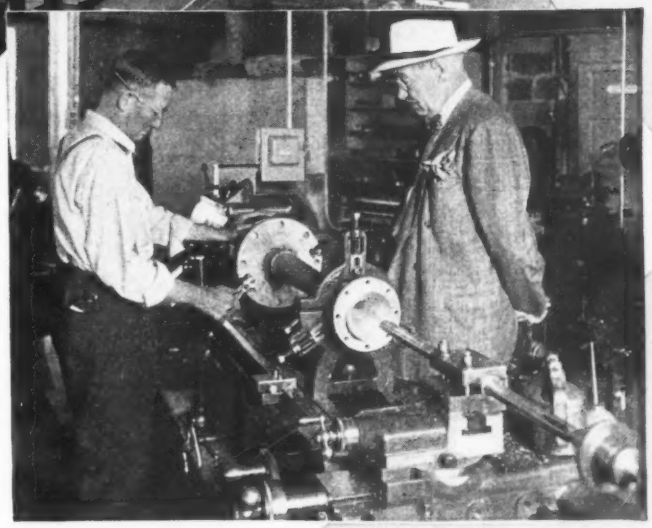
"People in Chicago like to do things in a big way, be it fires or stockyards, merchandising or lathes. It comes naturally. As naturally as recommending LeBlond Sliding Bed Gap Lathes for unusual jobs. Their versatility, performance and dependability establish production records in plants like the Republic Flow Meters Company. The operator shown here is boring a valve body to a tolerance of .001" with a LeBlond 32"/60" Sliding Bed Gap Lathe. He has used LeBlond Lathes for 26 years and 'they never let me down.' When an operator says *that*, you just can't hear sweeter sales music about a lathe."

ALBANY

"Here in the capital district I've found that companies like the Consolidated Car-Heating Company are pacing the new era of production. For many years Consolidated, which manufactures electric and pneumatic door operating equipment and electric heaters for railway cars and busses, have been LeBlond Regal Lathe conscious. That's because they're so thoroughly sold on the Regal. For instance, Consolidated makes all their own dies, fixtures and jigs, and have just finished a compound die which blanks, forms and pierces all in one operation—made largely on the 17" Regal."

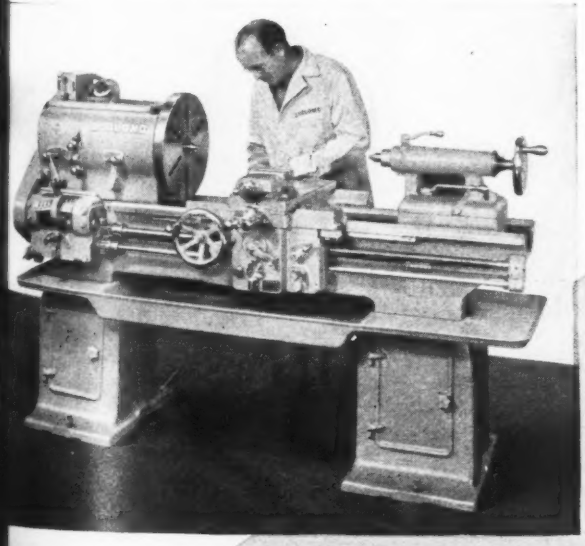
L. F. Hatton
Rolfe Pump and Machinery Corp.
Troy, N. Y.

DENVER



"Denver may be a city young in years, but for some time now, it's been the industrial center of the great midwest. Workers around these parts have a high degree of skill. They have more than ordinary respect for machines and equipment that produce results. And they're choosey when it comes to lathes. That's why they like LeBlond Regal Lathes. Like them, too, because they're easy to manipulate and still perform many of the functions of heavy duty lathes. Here, in the Neo-Chem Products Co., an operator is turning a venturi tube on one of several LeBlond 17" Regals used in this plant."

Richard Ives — Richard Ives Co.
Denver, Colorado



17" LeBlond Regal Lathe

These LeBlond Agents and many others . . . one of them near you . . . know metal turning as few men know it. Since they offer the largest line of lathes available from one manufacturer, their unbiased advice on the selection of a lathe for any specific use can be relied upon.

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio
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LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

For Every Load, Speed and Duty

"NORMA-HOFFMANN"

Precision Bearings

BALL, ROLLER, THRUST—3000 SIZES

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONNECTICUT

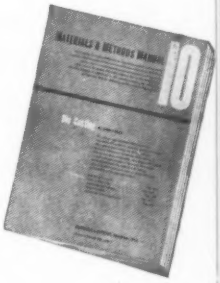
One of five self-contained H-P-M all-hydraulic die casting machines installed at The Hoover Co., North Canton, Ohio, for production of ink cole, vacuum cleaner castings

For precision parts *Quick..* use modern *die casting* equipment by H-P-M

short metal supply slowing up your pro-ction? Are you looking for a way to make ur product better, lighter—at lower cost? Here's a way to do it—by nonferrous design. the installation picture shows, The Hoover o. uses large, intricate die castings, precision-oduced on H-P-M *All-Hydraulic* High-essure Die Casting Machines.

The secret of successful production on large rts like these is the big, rugged, straight-line draulic die clamp, *an exclusive H-P-M design ature.* This outstanding development permits confining the pressure to the die cavities. There's less flash—and castings are more uniform. Automatic slowdown prevents die slam and results in less die wear and breakage. Also, there's automatic cycle control, hydraulic core pulls and hydraulic automatic ejection. These all add up to less operator fatigue, resulting in higher production output. With H-P-M you'll have less down-time for repairs—and less spoilage.

If our standard machines don't fit your die casting requirements, we can build production units to your specifications. May we talk it over?



For an authoritative, unbiased, twelve-page manual describing die casting materials and methods, write us for a copy of reprint manual No. 10.

HE HYDRAULIC PRESS MANUFACTURING CO. Mount Gilead, Ohio, U. S. A.

Branch Offices: New York, Philadelphia, Cincinnati, Cleveland, Detroit and Chicago. Representatives in other principal cities

HPM

All-Hydraulic Self-Contained **Die Casting Machines**

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

300 TWIN BENDS per hour!

With Two DI-ACRO BENDERS A difficult production problem of forming two bends in a long length of tubing was solved by "teaming up" two DI-ACRO Benders as illustrated. This dual-forming arrangement saved installation of special machinery. Two accurately formed bends are obtained in one operation—without distortion of the tube and at a cost competitive to power operated equipment. More than 300 pieces are completed per hour —600 individual bends.

"DIE-LESS DUPLICATING" Often Does it Quicker WITHOUT DIES

This is but one example of how DI-ACRO precision machines—Benders, Brakes and Shears—can accurately and economically duplicate a great variety of parts, pieces and shapes, without die expense. Write for Catalog—"DIE-LESS DUPLICATING"

← DI-ACRO is pronounced "DIE-ACK-RO".

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SKILLED CRAFTSMEN PREFER

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for all

SHEET METAL FABRICATION

SCROLL SHEARS

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SHEARS, FOLDERS, BRAKES FORMERS, ROTARY MACHINES

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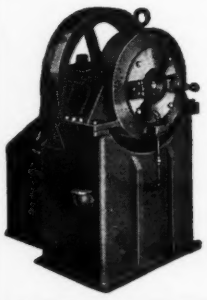


Swaging—*What* it is and *How* it is done on

TORRINGTON SWAGING MACHINES

All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

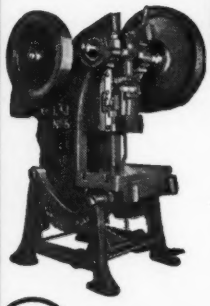
Examples of many possible operations by the Rotary Swaging Method:—

1 Point rods for drawing
2 Pointed rods and tubing
3 Tapered rods and tubing
4 Acetylene torch tips
5 Curling iron tubes
6 Bonding Ferrules to cables
7 Steel furniture legs
8 Tap blanks
9 Banding Rotating Bands on shells
10 Meat hooks
11 Refrigerator expansion bulbs
12 Sizing and Reducing wire

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

THE TORRINGTON CO.

55 Field Street Torrington, Conn.



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POWER PUNCH PRESSES

5 TO 79 TONS

No. 5 BACK GEARED

49 Ton Capacity
45 Strokes per minute
*10¼ Die Space
(Bed to slide, stroke down, adj. up)
4" Standard Stroke
6700 lbs. weight
Also available in plain flywheel type
*No. 5 Special has 15¼" Die Space

Write for Catalog.

STANDARD SINCE 1911

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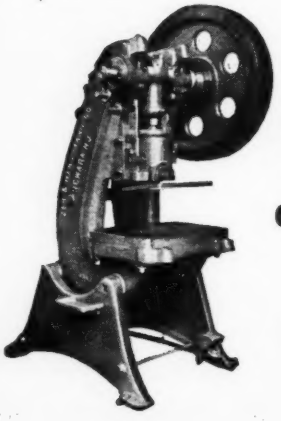
SUCCESSORS TO LOSHBOUGH-JORDAN TOOL & MACHINE



POWER PRESSES

of all types and sizes

ZEH & HAHNEMANN CO.

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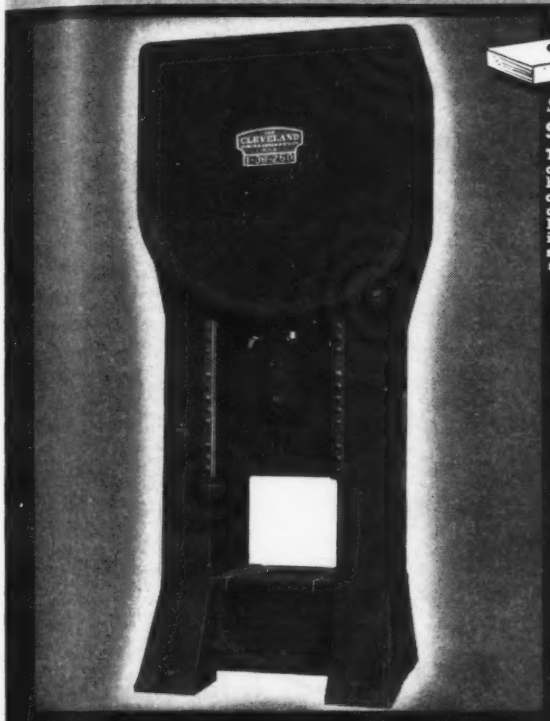
Modern CLEVELAND *Presses*

THERE'S A CLEVELAND POWER PRESS FOR EVERY REQUIREMENT



Single Point

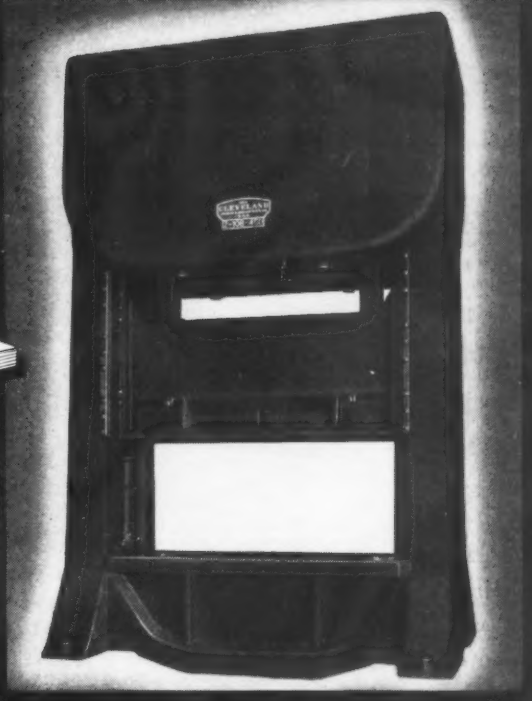
STRAIGHT SIDED

The Press illustrated has a capacity of 250 tons, bed area 42" by 36" and a stroke of 12". However, all Cleveland Modern Presses can be furnished in sizes and capacities to suit particular requirements.

Two Point

STRAIGHT SIDED

Provided with 20" stroke, 6" adjustment, 45" shut height and a bed area of 55" by 108", this Cleveland Two Point exerts a pressure of 450 tons, and this type can be furnished in numerous combinations of stroke, adjustment, bed area, etc.



Four Point

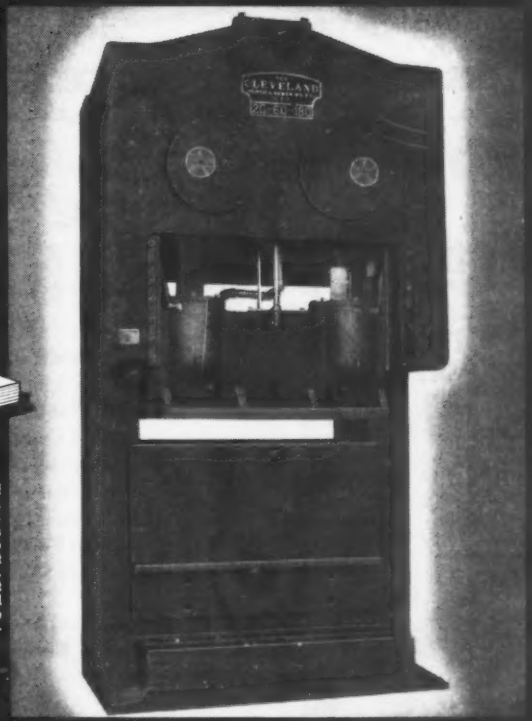
STRAIGHT SIDED

Cleveland Four Point Presses are arranged with a connection at (approx.) each corner of the slide and this feature assures uniform pressure whether the dies are on center or off center. Openings can be provided in the uprights to permit feeding material right and left across the dies.

Two Point

GAP

Except for the design of the frame, which is an overhanging Gap type, this Cleveland Press is similar in construction to the Modern Straight Sided type. The gears, flywheel and drive unit are completely enclosed in the crown and there are no overhanging projections.



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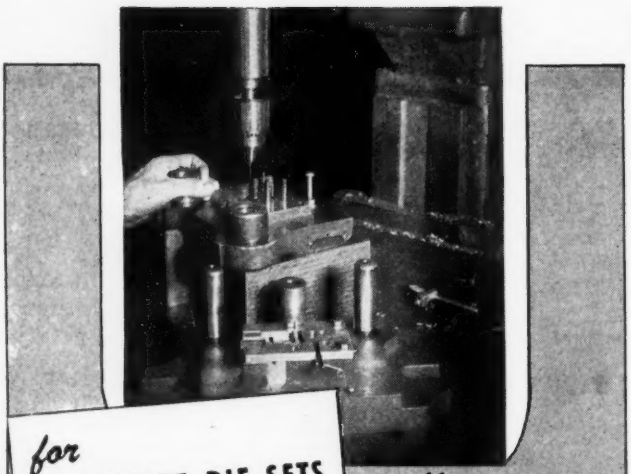

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You will never have to worry about the quality of your die sets once you place responsibility in the hands of skilled Producto experts. What is more, you'll regularly get faster and more efficient service from our SIX conveniently located assembly and service headquarters. Write for our catalog No. 9, if you do not have one in your file.

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Massively built with semi-steel castings for exceptional strength and rigidity. Large bed area and opening. Sliding surfaces precision ground and hand scraped. Positive, instant-acting clutch, extra heavy flywheel, streamlined design. NEW CIRCULARS AVAILABLE! Write today.

SPECIFICATIONS

Capacity Rating	28 Tons
Bed Area	13" x 22"
Bed Opening	6" x 9½"
Shut Die Height	9"
Standard Stroke*	3"
Flywheel Speed	125 Max.

**5" Stroke maximum on special order*

OTHER DIAMOND PUNCH PRESSES AVAILABLE in 7- 9- 12- and 14-ton capacities. Write for literature.

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MANUFACTURERS of the DIAMOND LINE of PRECISION MACHINE TOOLS and ACCESSORIES

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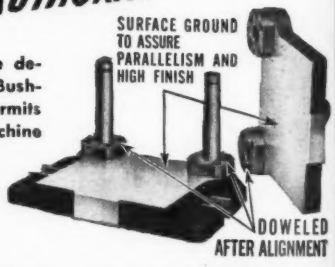
THE DIE SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.



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GRAY, Originator of First Practical Metal Cutter or Nibbler

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RAILS AND TIES for Lionel electric toy trains are assembled at the rate of 1250 per hour in this Bliss No. 21 Inclinable Press with 48", 8-Station Bliss dial feed and a staking die.

MINIATURE PRESSED METAL VERSIONS of the "real thing" are the toy manufacturers' contribution to a youngster's world of make-believe. Authentic streamlined electric trains that puff smoke, futuristic autos and planes, miniature typewriters, refrigerators, jeeps, tractors...all are "musts" in playing grown-up.

As you'd expect, Bliss leads the stamping press parade in this ever-changing march-of-the-toys, for Bliss makes every type and size of press—mechanical and hydraulic—necessary to blank, draw, form and assemble an endless variety of playthings, as well as their counter-parts in real life. While one Bliss press is busy forming the entire turret top of *your* new car, another is stamping its toy copy for the kids. A massive 2500 ton press blanks two boxcar chassis frames at a stroke, while smaller machines complete whole miniature "railroads" for the "living room express."

Toyland is but another of "Bliss' Stamping Grounds." Here, too, as in so many mass-production industries, Bliss equipment contributes mightily to profitable low-cost manufacture. In some way Bliss press-building experience—90 years of it—can help in solving your production problem. Try putting it up to Bliss.

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BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY

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For Mechanical and Hydraulic Presses
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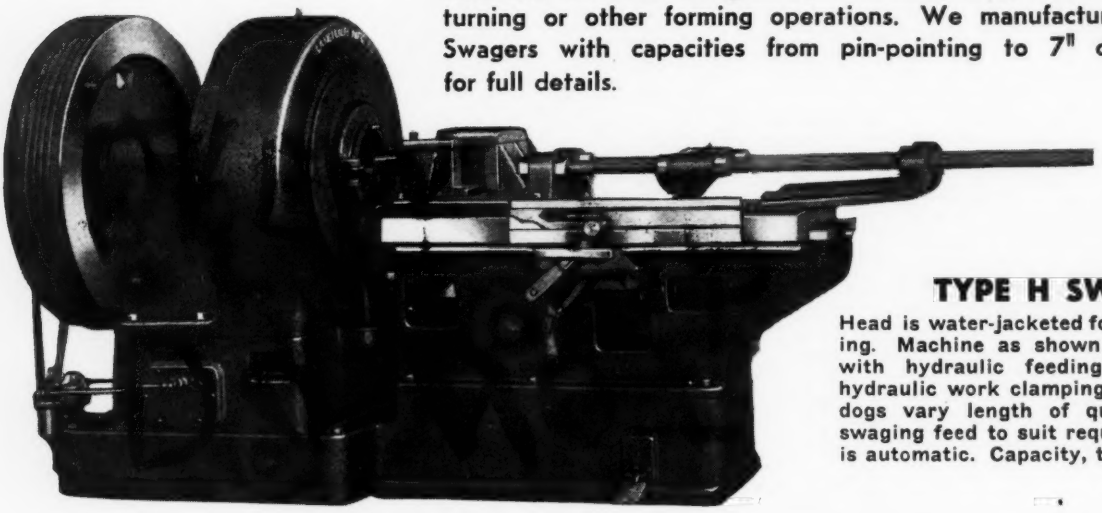
Save BY PUTTING YOUR WORK ON

LANGELIER NEW DESIGN SWAGERS

Designers and Builders of Hot and Cold Swaging Machines, Hammering Machines, Multiple Spindle Drilling and Tapping Machines, etc. Contract Swaging and Machine Work.

You can effect important savings in machining costs by using modern LANGELIER Swaging Machines. Economical, practical, rapid! Production from one of these Swagers is, in almost every case, greater than with turning or other forming operations. We manufacture many types of Swagers with capacities from pin-pointing to 7" dia. tubes. Write for full details.



TYPE H SWAGER

Head is water-jacketed for hot or cold swaging. Machine as shown here is equipped with hydraulic feeding mechanism and hydraulic work clamping jaws. Adjustable dogs vary length of quick advance and swaging feed to suit requirements. Return is automatic. Capacity, tubing, 3".

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DRILLING AND SWAGING SPECIALISTS FOR OVER 50 YEARS . . . INCORPORATED 1887

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Tested on the job in all types of industries, Lewis Machines have proved themselves thoroughly dependable.

Lewis Flexible Shaft Machines are made in sizes 1/8 to 1 1/4 H.P. with speed ranging from 600 to 9,000 R.P.M. A Machine for every possible need.

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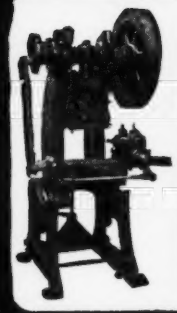

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DIAL FEEDS
ROLL FEEDS

For any size and type of press. Reels for feeding coil stock. Dial feeds for 8, 12 or 16 stations—1 to 3 operations. Single and double type roll feeds. Write for prices and specifications.

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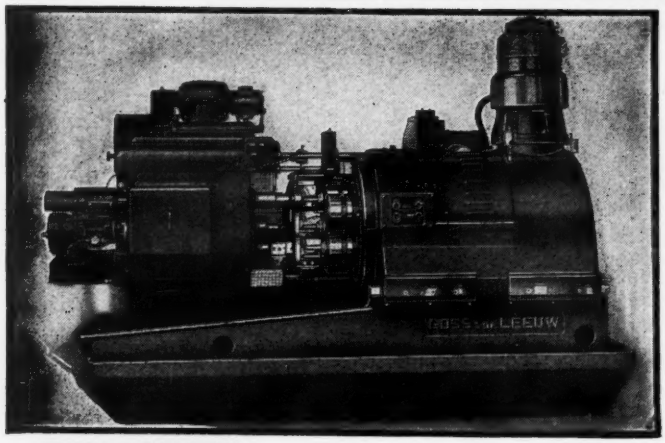

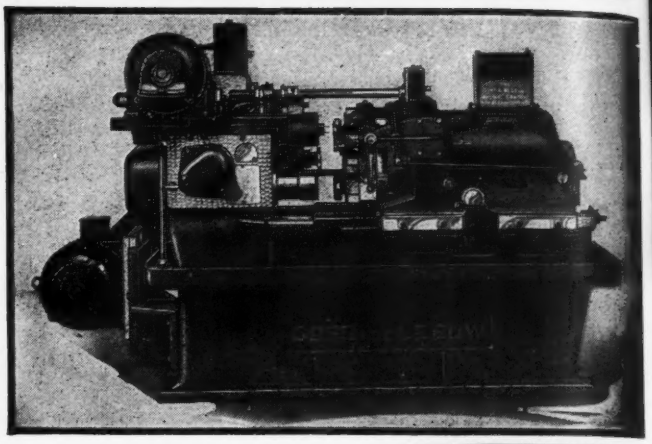

WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:
Lead Screw Threading on both types—Pre-loaded Anti-friction Spindle Bearings—Hardened Ways—Oversized Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

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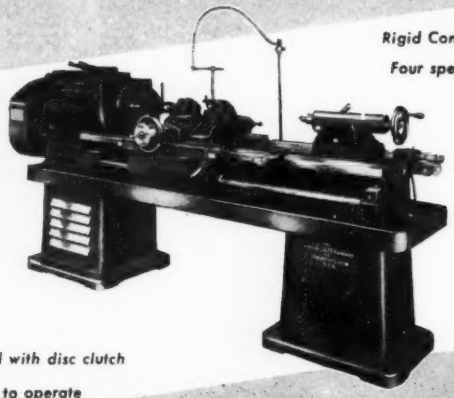
40 YEARS of EXPERIENCE
produced
the new COULTER AUTOMATIC THREADING LATHE

Rigid Construction
Four speed headstock



Equipped with disc clutch
Easy to operate

The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

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THE JAMES COULTER MACHINE CO.
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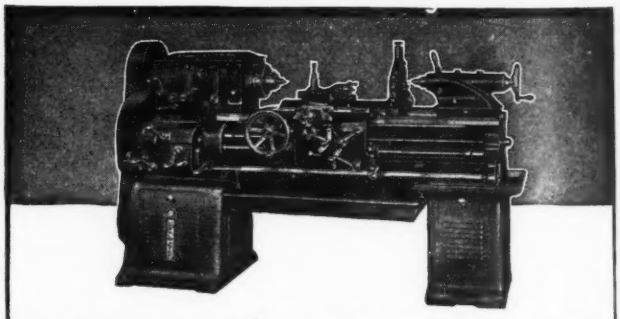

BRADFORD *Metalmaster* LATHES
have this standard equipment

- 12-Speed Timken Geared Headstock
- Quick Change Gear Device
- Double Wall Apron
- Tailstock
- Compound Rest
- Tool Post with Ring, Wedge, Square
- Steady Rest
- Face Plate
- Dog Plate
- Head Center Bushing
- Chasing Dial
- 2-Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button and Starter
- Vee Belt Drive
- Automatic Lubrication in Head
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- Mechanical Apron Clutch Control
- Threaded Spindle Nose

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1840—1947 CINCINNATI, OHIO

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dern merchandising owes much of its efficiency to a mod- production method—*Press Production*. The Press is ally suited to the production of panels for self-service re- erators display counters, shelving—the many duplicated ts in the mechanism of a tabulating cash register.

n the press departments and Stamping Plants of America, nly Die Sets and Die Makers' Supplies are recognized as a essary part of good presswork, because Danly means own *dependable accuracy*.

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- **ROCHESTER 4** — *16 Commercial Street*
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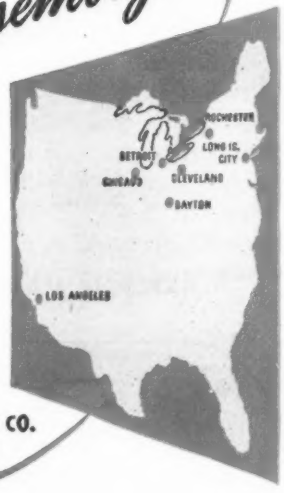
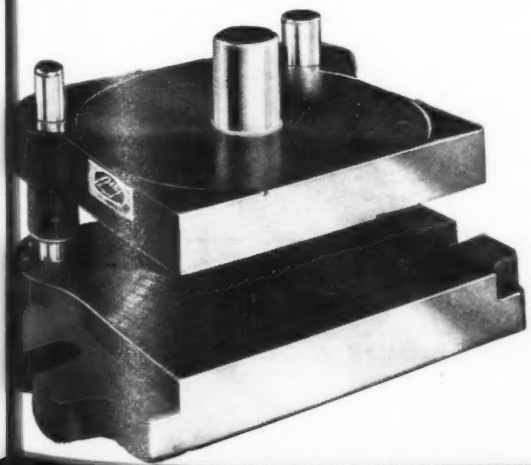
- **LONG ISLAND CITY 1** — *47-28 37th Street*
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles*





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DANLY DIE SETS

Welded Steel Fabrication

A sure start on

Lathe Profits

Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes.

The profit margin on any metal turning job hinges largely on the performance of the lathe used... When the "Start" button is pressed on an Axelson Heavy Duty Lathe, this starts your metal turning profits too... Then again as the lathe *cuts* it *cuts* the overall piece production cost to the lowest possible minimum... Built to maintain the utmost in accuracy, at the lowest upkeep cost, Axelson Lathes long have proven their worth in production lines throughout the world... Axelson Lathes *cut* metal and *costs* alike.

AXELSON LATHES CUT COSTS

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AXELSON *Lathes*

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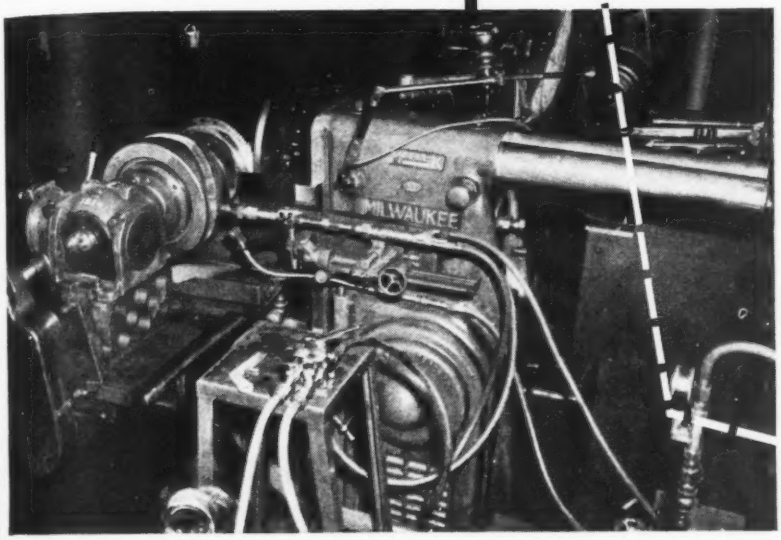
DEPENDABLE FOR OVER A QUARTER CENTURY

how to lengthen the life of machine tool parts

by Airco Flame Hardening



PART: Cam Track in Barrel Cam
MATERIAL: Meehanite
HARDNESS OBTAINED: 62 Rockwell "C" 86 Scl.
DEPTH OF CASE: 1/8 inch
SET-UP (Change-over) TIME: 3 hours
CYCLE TIME: 20 minutes
DISTORTION: None measurable
Performed on Kearney & Trecker 2K Universal Horizontal Milling Machine with cam-milling saddle. Standard Airco tapered cylindrical tip, flame-hardening torch, universal adjustable bracket, and accessories used.

Milling machine converted to flame hardener in 3 hours, barrel cam hardened in 20 minutes

HOW IT WAS DONE — After cam was milled, holder and torch were clamped to column face of milling machine. Both sides of cam track were flame hardened in one revolution with the identical set-up used in machining the cam. Since contours followed in hardening were identical to those in milling, uniform hardness and depth of case were achieved.

Because of mass of the barrel cam, certain extra precautions were used. The coolant was circulated through a refrigerating unit mounted at rear of machine. An auxiliary quench was used. Baffle plates deflected heat from machine and dividing-head surfaces. No measurable distortion occurred. No damage resulted to milling machine or attachments used.

This is typical of the type of equipment that can be flame hardened to extend service life. Flame treatment does not effect properties of the core — wear-resisting surfaces are produced while still retaining the toughness and ductility of core material. Distortion is so negligible that hardening is normally done after finish grinding.

Airco flame treating can be economically applied to single parts or to units in mass production. Normally standard machine tools, with standard Airco oxyacetylene equipment, are all that is needed.

If you are making or using parts that will give longer life when surface hardened, fill in and mail the coupon for copies of Oxyacetylene Flame Hardening Handbook and Flame Hardening Apparatus Catalog No. 90. Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices: Houston 1, Texas. Represented internationally by Airco Export Corporation.

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Originators of **Modern Oxyacetylene and Electric Arc Methods for the Metal Working Industry**

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Please send me, without obligation, a copy of
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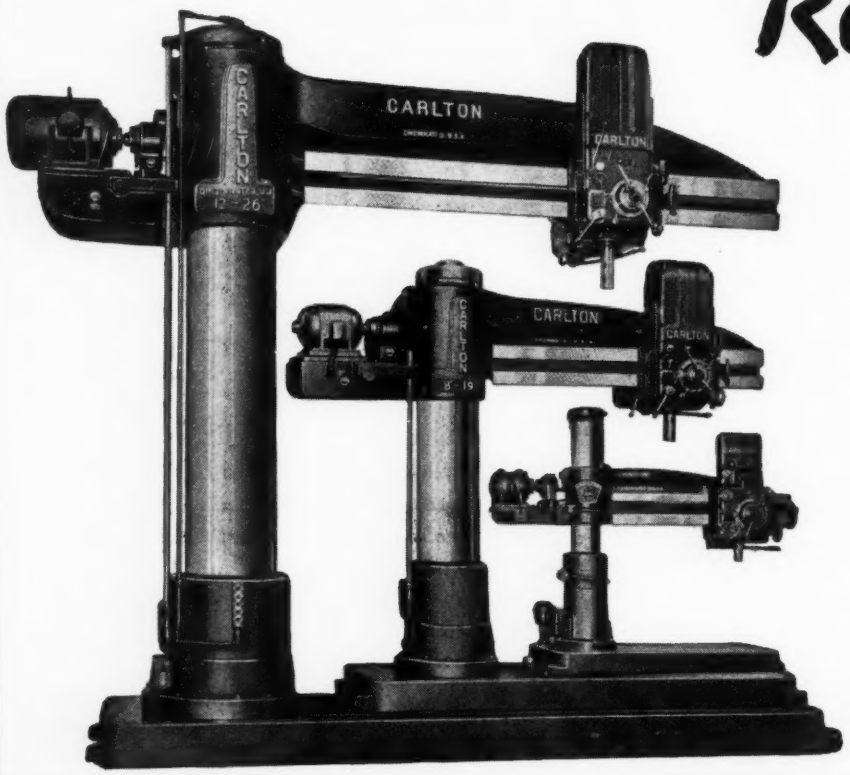
(I)—1

CARLTON Radials



The Carlton Machine Tool Co. offers a complete line of Radial Drilling Machines in sizes ranging from 3′ arm to 12′ arm, and from 9″ dia. column to 26″ dia. column. Carlton Radials are delivering outstanding service in almost every large manufacturing plant in the country, as well as railroad shops, shipyards, steel mills, etc. Carlton all-ball-bearing construction with original low-hung drive to spindle makes operation—even under heavy loads — smooth, vibrationless and chatter-proof. Many other modern features available. For greater production, greater economy and satisfaction, ... investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO

If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

• BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT

then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

For YOUR special problem, go "HOLE-HOG," write us for any information you may need.

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MOLINE, ILLINOIS

MOLINE TOOL CO.
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SPEED MARKING AT ITS BEST

This Noblewest Rapid Precision Marking Machine is not only *streamlined* in appearance, but gives you *streamlined* performance in speed, quality of marking, at lower costs. Production speeds are practically unlimited. It can be tooled for marking many sizes and shapes of pieces. Employs the famous Noblewest *rolling process.* Model 157 shown here with pneumatic die pressure. *Write*

Noble & Westbrook Mfg. Co.
15 Westbrook St.
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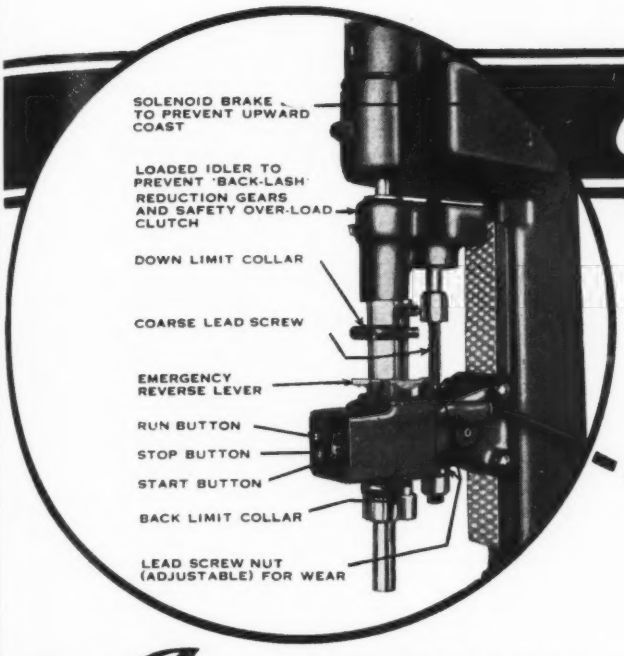
MARK IT BEST WITH
NOBLEWEST
Hi-Speed Marking Machines



Avey FEATURE No. 3

THE Avey TYPE MA-6
AVEY-MATIC POWER FEED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

features

reversing motor, positive lead screw tapping — for accurate thread and tapping in soft material or thin sheets

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
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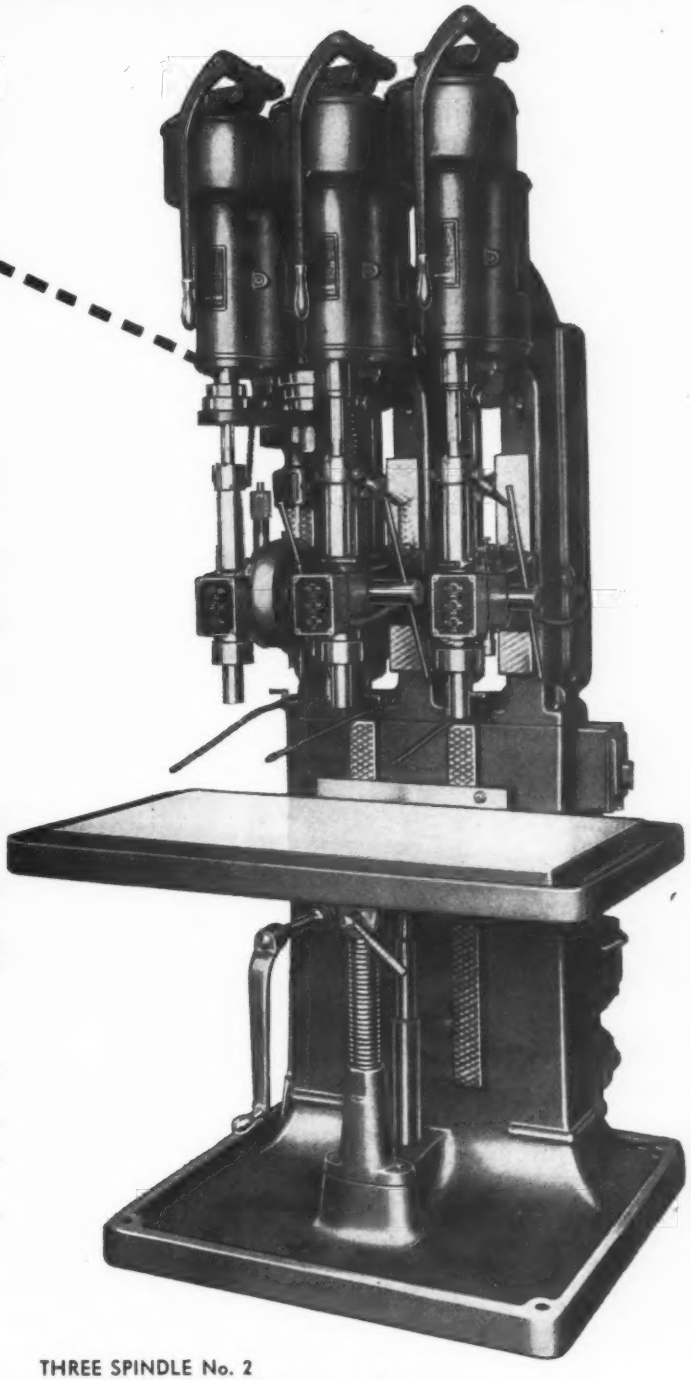

THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

Avey DRILLING MACHINES
CINCINNATI, OHIO

Heavy Duty TAPERED PIPE TAPPING *Easy With* BUHR *TAPPING HEADS!*

When production problems arise—consult Buhr for the solution . . . Specialists in multiple spindle drilling, reaming and tapping equipment for over 25 years. We have helped many manufacturers speed production for greater profits.

Individual Lead Nut Type Spindles

4-spindle head is driven directly from an electric motor with change gears to provide correct spindle speeds.

Spindles are of the individual lead nut type providing a quick change of lead screws and nuts to adapt to use of 1¼, 1½, 2, 2½ and 3" collapsible tapered pipe taps.

Taper tap feed and collapsing mechanism is enclosed at rear of head under motor mounting bracket.

Write us for illustrated literature

B3805

All gears are shaved and induction hardened

BUHR MACHINE TOOL CO.

GREEN & DAVIS STS. ANN ARBOR, MICHIGAN

Faster, Better Tapping at *LOWER COST*

PROCUNIER TAPPING MACHINES

Practically eliminate tap breakage. Operate continuously at high speed. Cut rejections to an absolute minimum.

Low-cost Procunier Tapping Machines are the only machines with our compensating springs for the automatic adjustment of tap driving pressure. Pre-set independent of the operator, two long spiral springs exert the desired pressure on the tap, regardless of pressure on the foot pedal. Tap breakage is all but eliminated, tapping is speeded up and consistent accuracy is maintained.

An automatic lubricating mechanism delivers the proper amount of lubricant to the tap at the precise moment, washing all the chips away.

Other features include the Procunier Hi-Speed Tapping Head with many exclusive advantages —and the Tru-Grip Tap Holder. Send coupon today for circular with full details, specifications and prices.

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City.....State.....

Accurate External Threading With Acorn Dies

Do external threading jobs faster with a Procunier Tapping Head which holds standard Acorn Dies. Cut external threads quickly in brass, die castings and aluminum.

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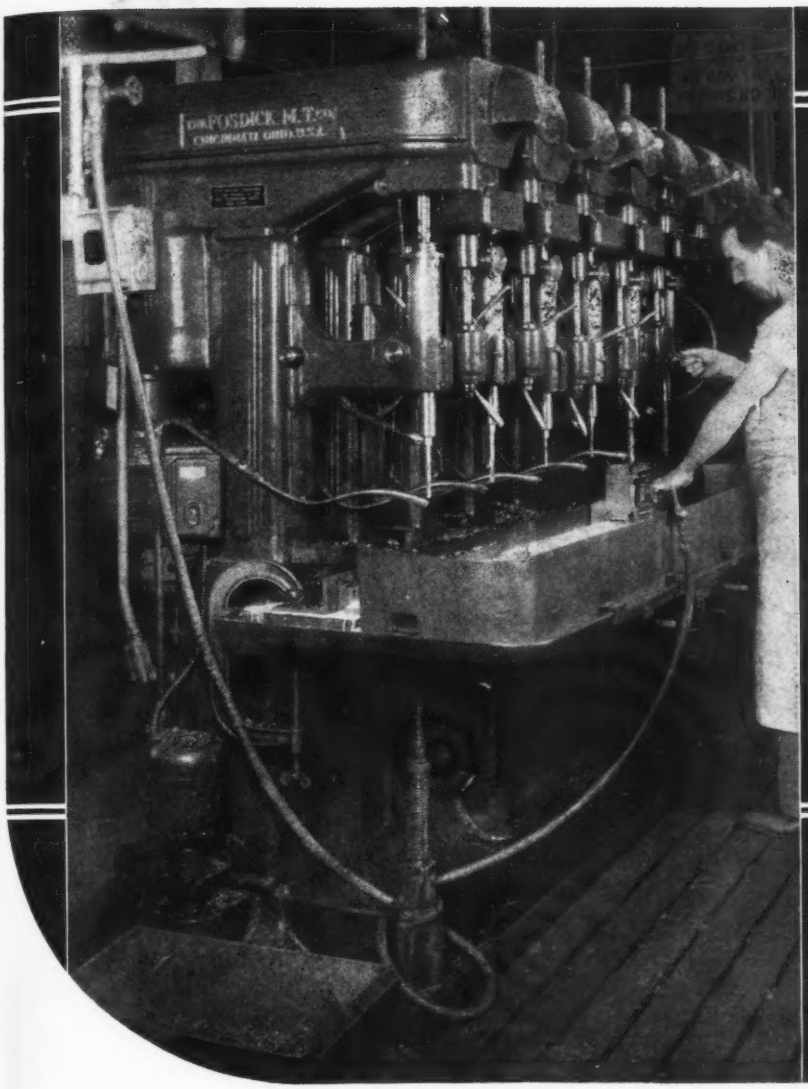


Progressive Operations

are easy
fast and
economical
on the

FOSDICK
HIGH SPEED DRILL

● On work requiring progressive operations, such as drilling, reaming, counterboring and tapping, the six spindle Fosdick High Speed Drill speeds up production and lowers costs.

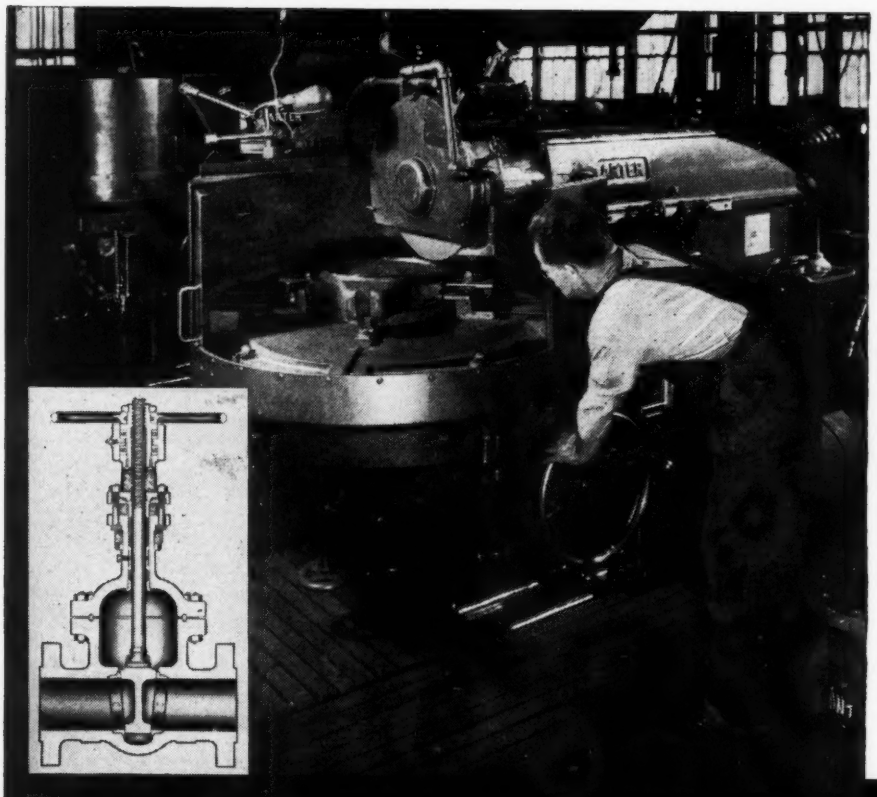
For example, on the job shown, drilling, reaming and tapping operations are being performed successively. Work moves from spindle to spindle until all operations are completed.

Start, stop and speed changes for motors are accomplished by pushbuttons conveniently located at front for the operator. Six and nine spindle speeds are obtainable with standard 1800 R. P. M. motor. With a two speed motor 12 and 18 speeds are available.

Thus, ease of control and flexibility of operation permit work requiring holes up to 1-1/4" diameter to be handled easily, quickly and economically on a Fosdick High Speed Drill.

For full details of construction —operation and various types and models available, write for the Fosdick High Speed Bulletin — H. S. M.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23. . . . OHIO



ARTER

ROTARY SURFACE GRINDERS

are employed to grind the disc used in steel gate valves, insuring accuracy needed for continuous successful operation. These discs are ground on MODEL B ROTARY SURFACE GRINDERS using 10 degree angular fixture.

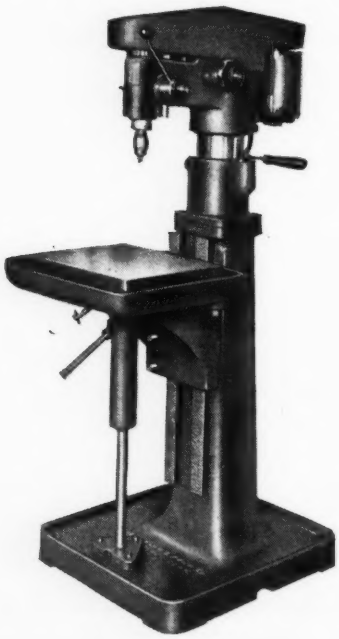
Another interesting ARTER grinding job—another example of ARTER versatility.

MODEL B GRINDERS are made in capacities up to 40".

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

The Drill with a Hundred and One Speeds



All Speeds Instantly Available While Machine Is Running

M-125—3/8 Cap.
M-96—7/8 Cap.
1 to 6 Spindles

Correct speed at the turn of a knob.

Speed Chart on front of head.

Ability to obtain exact speed for diameter of drill and material to be used results in less breakage, fewer grinds and higher efficiency.

•

Write for Circulars.
MM-125 MM-96

THE TAYLOR & FENN CO., Hartford, Conn.

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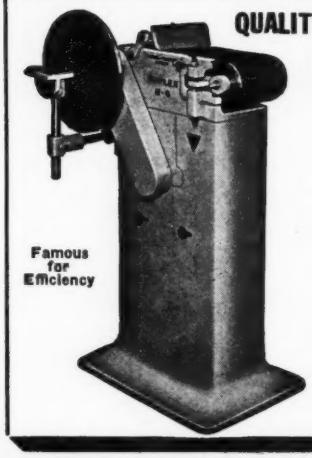

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DUPLEX M-6

HIGH SPEED BAND AND DISC GRINDER

The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48' band for finishing. Precision-built to post war standards.

Other styles and sizes in New Booklet on Finishing. Write Today.

WALLS SALES CORP.
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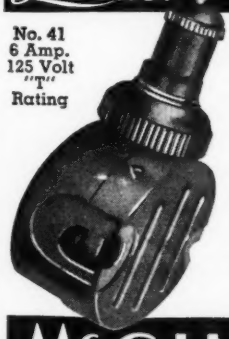
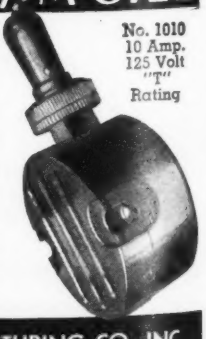
Levolier Switches by McGILL



No. 41
6 Amp.
125 Volt
"T"
Rating

Levolier Switches are available for fluorescent and incandescent lighting, or fractional HP. control. Made in 3 to 10 amp. capacity, single pole, two circuit, series multiple and 3-way pull. Tested under more severe conditions than required by Underwriters' Laboratories. Write for catalog. Electrical Division.



No. 1010
10 Amp.
125 Volt
"T"
Rating

McGILL MANUFACTURING CO., INC.
VALPARAISO, INDIANA

Fast roughing... High finish

ABRASIVE M-34

VERTICAL SPINDLE SURFACE GRINDER

SPECIFICATIONS

Work Capacity: 24" long, 8" wide, 12" high. *Spindle:* Built-in 5 hp motor, 3450 R.P.M. ball and roller bearing. *Wheel Size:* Segment type, 6" diam. *Table Size Overall:* 59" x 10½". *Net Weight:* 3000 lbs.

ABRASIVE

ACCURACY BOOSTS PRODUCTION

REMOVES 1/32 INCH ON MOLYBDENUM STEEL WITH 10 MICROINCH FINISH

The ABRASIVE M-34 with motorized spindle using a 24 grit wheel removes 1/32" from each side of this molybdenum steel oyster dredge bar tooth. Fast and accurate, it produces 40 pieces per hour — to a 10 microinch finish. For grinding small flat dies, washers, punches, parallels, raising blocks and similar work the M-34 is ideal. The motorized spindle delivers 5 h.p. directly at the cutting point without gearing or belting. There's no warm-up period with the M-34 . . . it grinds to close tolerances immediately upon starting. The one-piece bed casting minimizes vibration and assures lifetime accuracy. Table feeds are automatic, with hydraulic shock absorber to cushion table reversal. Standard equipment includes wet grinding attachment with motorized pump, tank, etc.

Write for detailed Bulletin.

• • •

For information regarding Abrasive Machines on the Government Surplus Tool List, send us the serial number of the machine. We will endeavor to provide attachments, accessories and repair parts as desired.

ABRASIVE MACHINE TOOL CO. · EAST PROVIDENCE 14, R. I.

THEY STAY TRUER . . . LONGER

High quality grinding becomes high economy grinding with VITRIFIED WHEELS. They stay truer—longer. They will not gum or glaze. And they are not affected by heat, cold, oils, or acids.

Let our engineers study your grinding jobs and make recommendations for greater service and economy. No obligations, of course.

VITRIFIED WHEEL CO.
WESTFIELD, MASS.

PRECISION REID SURFACE GRINDERS

REID'S *PRECISION* MANUFACTURING for Over 46 Years Is Your ASSURANCE

IT'S PROVEN!

The "Know How" experience gained over this long period is built into every REID PRECISION SURFACE GRINDER.

BECAUSE OF

DEPENDABLE ACCURACY
ECONOMICAL PRODUCTION
CONTROLS AT YOUR FINGERTIPS

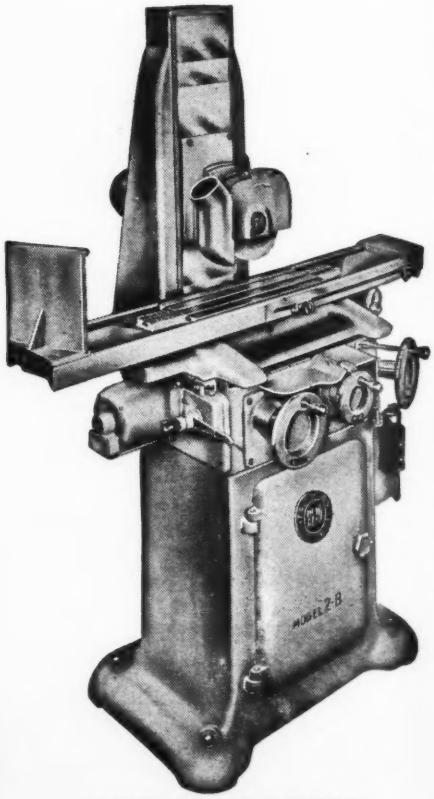
Leading shop men everywhere say,

"for Close Tolerance, use a REID!"

The Reid Model 2-C Hand-Feed is an exceptionally fine machine for tool, gage, die and certain production grinding. Machines equipped for wet grinding if required.

EXCELLENT DELIVERIES DISTRIBUTORS IN ALL SECTIONS

Write to Dept. B for illustrated bulletin and prices.



MODEL 2-B ALL-ELECTRIC

REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

ANNOUNCING The New HEAVY DUTY ACE

Built Specially for TUNGSTEN CARBIDE

The machine shown is the Oliver Heavy Duty ACE Tool and Cutter Grinder. It is an adaptation of the standard model intended for the heavier work of gumming and gashing cutters and for use in grinding cutters tipped with Tungsten-Carbide. It retains all the desirable qualities of the standard machine, but is equipped with a much heavier ram, larger ram bearing, a heavier motor and a heavier spindle. The frame has also been increased in weight and everything done to insure vibrationless grinding. The same type of fixtures are used on this machine as on the Standard ACE. The Oliver ACE Tool and Cutter Grinder has such exclusive features as:

A fixed diamond which compensates for the wear of the wheel.
A means for grinding eccentric relief on milling cutters and reamers.
Correct clearance obtained by direct reading—no computations or tables.
Grinding on the top tooth of the cutter in full view of the operator.
Comfortable standing position of operator.
No special attachments needed for grinding all regular (and many special) milling cutters.
For grinding of Tungsten Carbide in its many forms.

The New Oliver ACE Tool and Cutter Grinder will prove a most efficient piece of equipment.

OLIVER INSTRUMENT CO.
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IT'S THE BACKBONE
OF PRODUCTION

OLIVER OF ADRIAN PRODUCTS

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TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

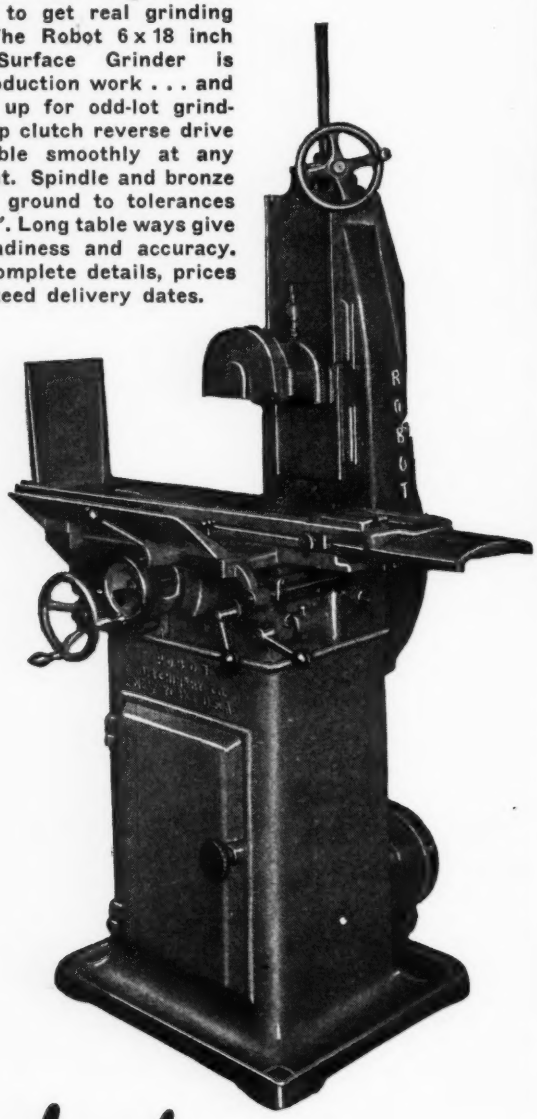
Robot

PRECISION SURFACE GRINDER

Right!

FOR ECONOMY GRINDING JOBS

Speed up the grinding of all types of small parts. Release larger machines for larger work. That's how to get real grinding economy. The Robot 6 x 18 inch Precision Surface Grinder is ideal for production work . . . and quickly set up for odd-lot grinding, too. Slip clutch reverse drive reverses table smoothly at any definite point. Spindle and bronze bearing are ground to tolerances within .0001". Long table ways give greater steadiness and accuracy. Write for complete details, prices and guaranteed delivery dates.



Robot MACHINERY CO.

326 TEN EYCK STREET BROOKLYN, N. Y.

Telephone EVergreen 7-4084-5-6

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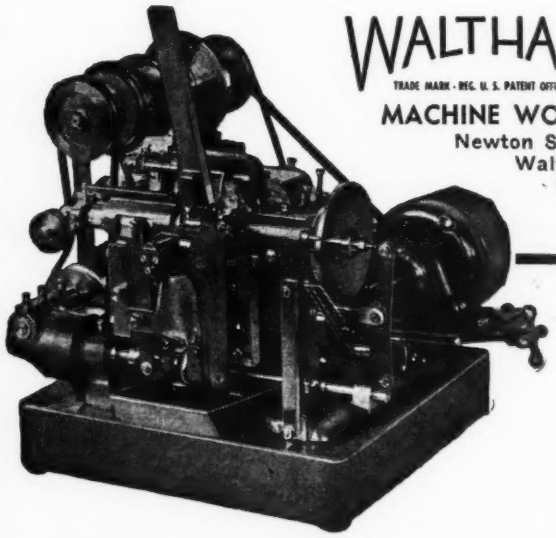
HIGH ACCURACY ON FINE PITCH JOBS

Here's a compact, high production machine that will produce accurate results on small jobs. Individually driven, cam-controlled workslide and automatic loading and unloading eliminate lost motion. Write for full details of this and other Waltham machines for accurate small part production.



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TRADE MARK - REG. U. S. PATENT OFFICE

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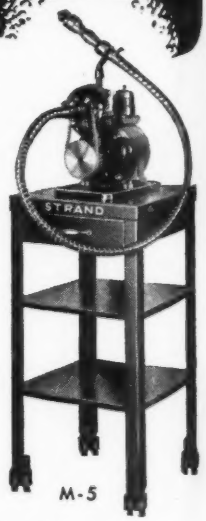
Newton Street, Waltham, Mass.

when you want Speed- when you want power-



. . . in your job of grinding, polishing, buffing, sanding, drilling, reaming, screw-driving or nut-setting, you want a Strand Flexible Shaft machine, because a Strand will do it faster, better, and stand up to it longer.

Strand Flexible Shaft machines provide constant speeds with greater operator convenience. Hundreds of attachments easily interchanged—125 types and sizes—models include vertical and horizontal type machines from 1/8 to 3 h.p. Distributors in all principal cities.

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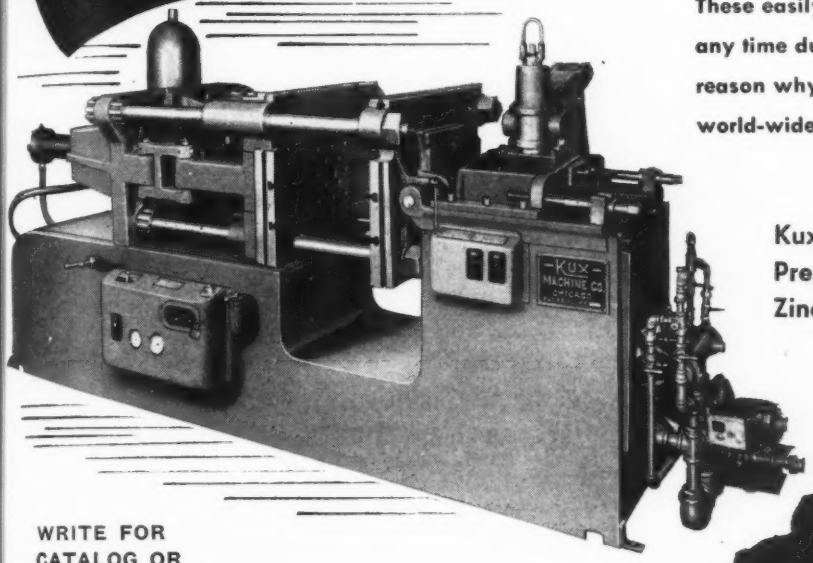
KUX Die Casting Machines are the Safest, Most Easily Operated Machines Built



15 different types and sizes—each equipped with proved safety features

Every operation of Kux Hydraulic Die Casting Machines is automatically controlled by electrical timing devices. These easily adjusted timers can be put into action at any time during the casting cycle—they are an important reason why Kux Die Casting Machines have a world-wide reputation for being the safest machines built.

Kux Produces the Most Complete Line of High Pressure Die Casting Machines Available, for Zinc or Aluminum Castings.

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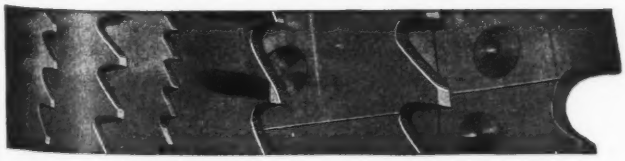


Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.

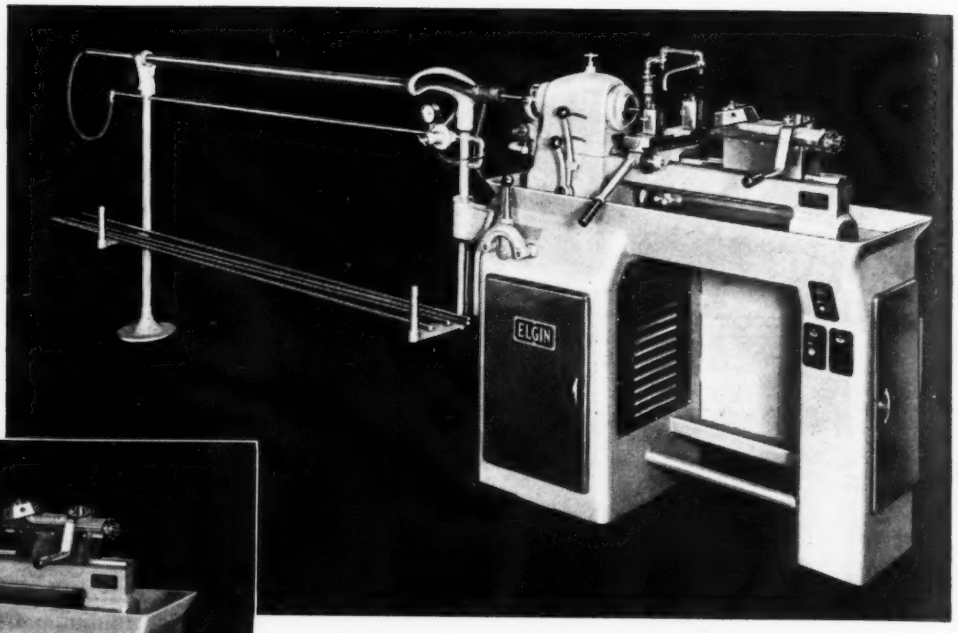
ROCHESTER NEW YORK

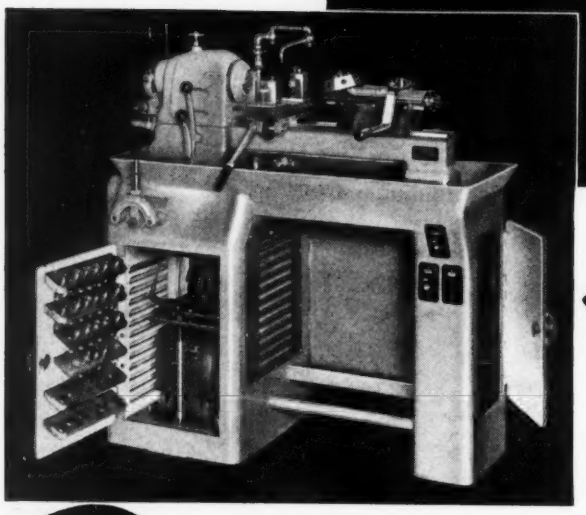
BETTER Small Part Production

with THE FREW HAND MILLER

Get better production and release larger machines for large work! Use the FREW Hand Miller for accurate, economical production of small parts. Heavy construction and "big machine" features guarantee accuracy on heavy cuts. Table size 16¾" x 5¾" makes a wide range of work possible. V-belt drive and Timken-equipped spindle assure smooth operation at all speeds.

THE FREW MACHINE CO. 121 E. LURAY ST. PHILADELPHIA 20, PA.





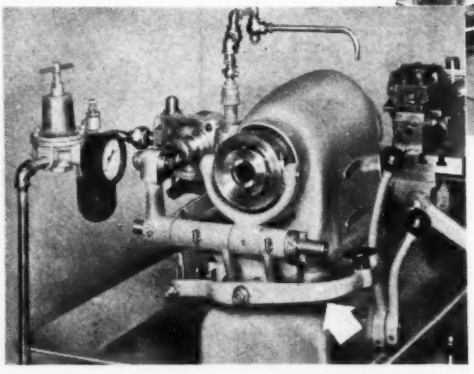
2 Hand Screw Machine with Air Operated Collet Closer—an Ideal Second Operation Machine

The Pneumatic Collet Closer (described in detail below) provides speedy, positive collet control. Pressing down lever opens collet and keeps it open; simply releasing lever closes the collet. This machine can be supplied with No. 10 BS Collet, No. 11 BS Collet or No. 5C Elgin Collet.

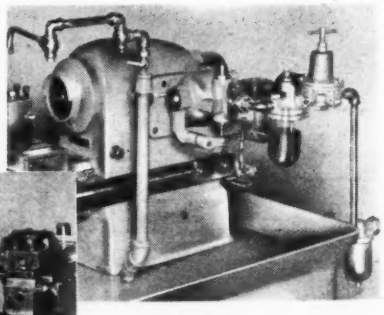
3 new ELGIN

ALL THREE MACHINES may be equipped with Pneumatic Collet Control — a real aid to speedier production, lower costs!

Exclusively Elgin designed and manufactured, the Pneumatic Collet Closer is available as an integral part of any of the three Hand Screw Machines shown above. Pressing lever (arrow) opens collet and keeps it open; releasing lever closes collet instantly. Very economical in air consumption — valve is placed close to cylinder, giving very short ports and admitting just enough air for the smooth opening and closing of the collet.



View from front of machine



Rear View

ELGIN

1 Bar Feed Hand Screw Machine (Air Operated Feed)

The Pneumatic Bar Feed is available as a single feature, or in conjunction with Pneumatic Collet Closer. In the latter case, feeding and chucking are accomplished almost instantaneously by simply pressing and releasing the air control lever. Push lever down—collet opens and stock is fed. Release lever—collet closes and stock is instantly locked into place. Available with No. 10 BS Collet (5/8" capacity), No. 11 BS Collet (13/16" capacity) or No. 5C Elgin Collet (capacity, 1" rd., 23/32" sq., 7/8" hex).

Hand Screw Machine with Pedal-Controlled Drive Clutch—a High-Speed Machine 3

Motor runs continuously — pedal-controlled Drive Clutch permits fast stop and fast start of spindle as often as 25 times per minute without overload on motor. Clutch operated by Right Foot Treadle. Pneumatic Collet Control operated by Left Foot Treadle or Hand Lever, whichever is most convenient. Clutch Treadle can be locked in for constant spindle running. Equipped with No. 10 BS Collet, No. 11 BS Collet or No. 5C Elgin Collet.

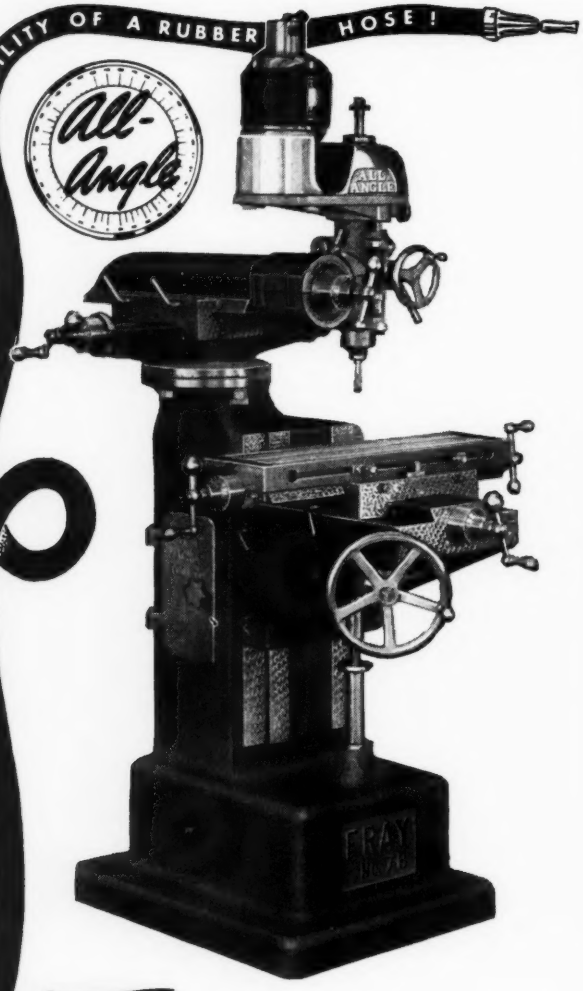
MACHINES FOR SPEED AND ECONOMY!

Important improvements that definitely assure speedier production and lower costs, are embodied in each of the three newly designed Elgin Precision Hand Screw Machines announced here. The improvements include: (1) Air-Operated Bar Feed which speeds the feeding of round, square and hex stock; (2) Pneumatic Collet Closer which gives quick "fingertip" control of collet opening and closing with minimum air consumption; (3) Drive Clutch with pedal control which permits starting and stopping of spindle (with motor running) as often as 25 times per minute. Elgin Screw Machines with any one of these improvements—or any combination of them—are available with No. 10 BS Collet, No. 11 BS Collet or No. 5C Elgin Collet. Each of these machines has a 9" swing and is equipped with the Elgin Variable Speed Drive (120 to 3800 RPM). And each model embodies the same efficient design, careful construction and smooth operation that have made the Elgin Line a standard of excellence in the field of precision bench tools.

TOOL WORKS 1770 BERTEAU AVE., CHICAGO 13, ILL.

FLEXIBILITY OF A RUBBER HOSE!

All-Angle



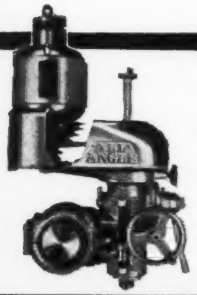
Fray

PRECISION RAM TYPE NO. 7-B

VERTICAL UNIVERSAL

MILLING MACHINE

- Flexible
- Sturdy
- Universal
- Easy to operate
- One set up
- All angles quickly obtained



- Four Sizes
- Four Types
- Adaptable to all Milling Machines

For further information write Dept. A

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DOUBLE SAVING!

Multiple tooth cutters give a broaching pull cut that speeds keyway cutting and prolongs cutter life. Davis design makes setting up—even of work tapering as much as 3" per foot—a matter of a few minutes. Here's a DOUBLE SAVING that means a lot, whether you use the Davis Keyseater for varied job work or long run production. One Davis Keyseater and the necessary Davis cutters will produce all keyways up to 14" long, from 1/16" to 1¼" in width.

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Write for bulletin giving complete details and specifications.

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MILLING MACHINES and ATTACHMENTS

Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3, and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

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Gear Cutting and Machines

Gear Specialists since 1904

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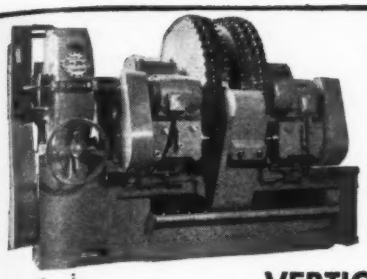
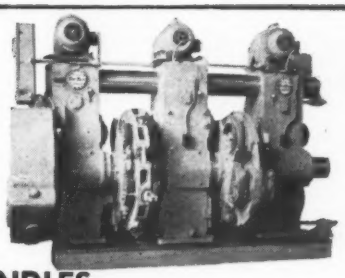


Roto-Matic MILLERS



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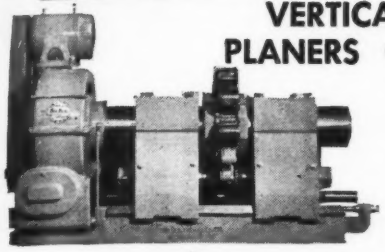
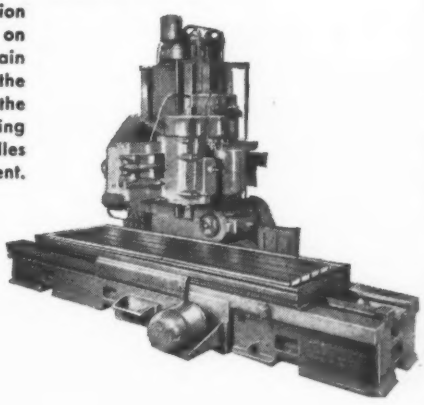
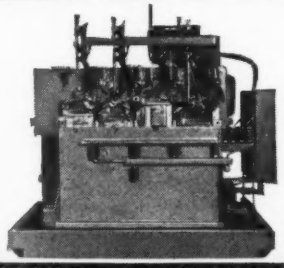
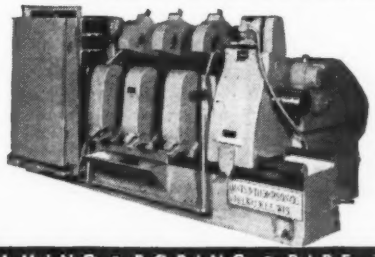
VERTICALS • SINGLE AND MULTIPLE SPINDLES
PLANERS • RISE AND FALL • VERTICAL INDEXING



The ROTO-MATIC principle of continuous production insures the maximum of production and accuracy on any job to which a Miller has been adapted. Chain clamping mechanisms, where adapted, leave the operator free to load and unload parts. On the larger type Rotary Drum Type Millers finishing spindles are adjustable for toe cut. All spindles have provisions for micrometric endwise adjustment.







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MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES
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—Rowbottom for Cams—

A SPECIALIST SERVICE THAT SAVES TIME!

Our facilities are devoted entirely to cam design and cam making. Our equipment enables us to produce cams of any size or type . . . in any quantity. Our experience has helped thousands of engineers and production men to solve their problems of cam application, cam design and cam manufacture. Give us the job of producing your cams and save valuable production time by releasing skilled mechanics and valuable machines for other work.

THE ROWBOTTOM MACHINE CO.
WATERBURY, CONN.
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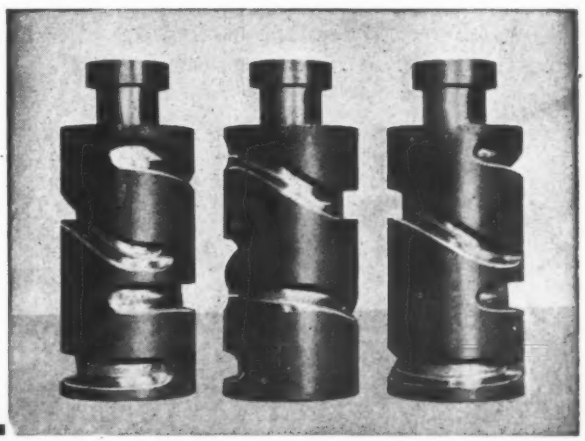
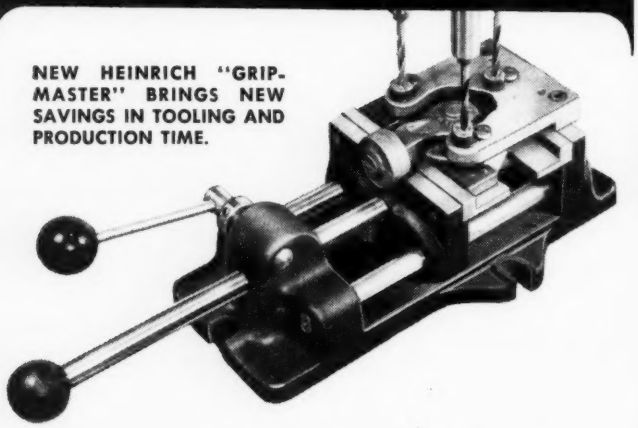


USE WORLD'S FASTEST VISE

CUT COSTS UP TO 75%

ON JIGS AND FIXTURES

NEW HEINRICH "GRIP-MASTER" BRINGS NEW SAVINGS IN TOOLING AND PRODUCTION TIME.



You can stop the heavy expense and time losses common in the building of special jigs for drilling and light milling operations. Use the Heinrich "Grip-Master" . . . the World's fastest vise . . . as a base-structure. Built-in bosses and removable parallels permit easy attachment of bushing plates and locating jaws. You can speed up loading and unloading unbelievably, thanks to the large jaw openings of the "Grip-Master" and its revolutionary *screwless* feature.

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Ask your Mill Supply Dealer about the Heinrich "Grip-Master." If he does not have a stock, write for folder that illustrates and describes the money-saving uses of this amazing tool.

HEINRICH

Grip-Master

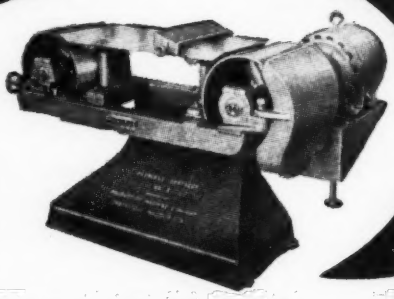
DRILL PRESS TYPE SCREWLESS VISE

NATIONAL MACHINE TOOL CO.

DEPT. 147-A RACINE, WISCONSIN

PEERLESS SURFACING MACHINES

FAST ON WOOD METAL PLASTICS



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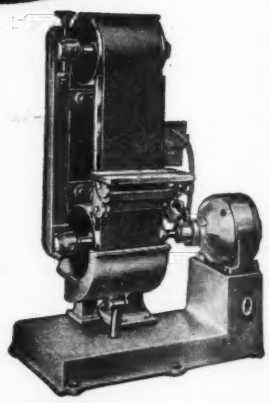

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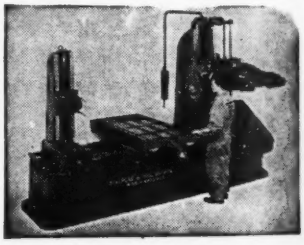

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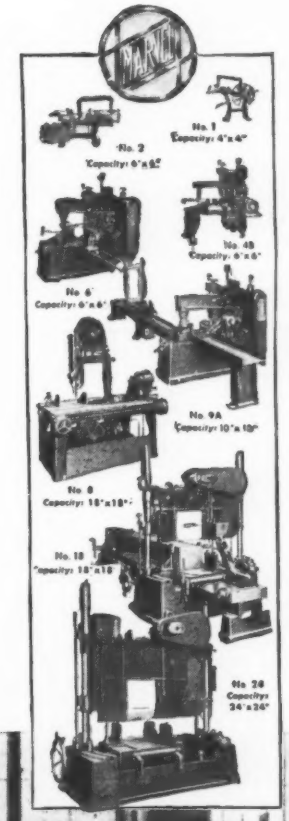

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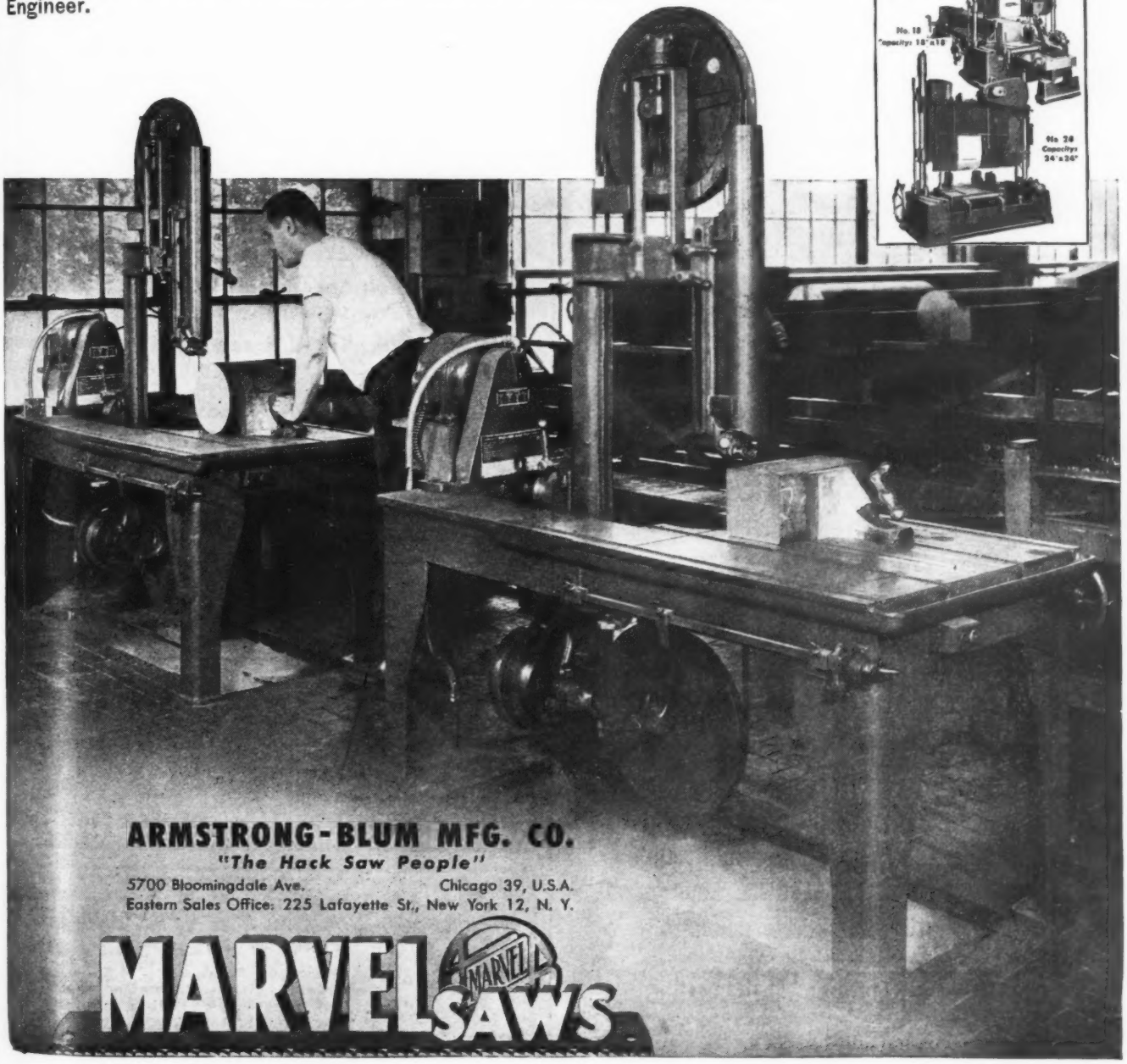

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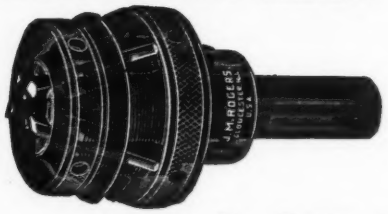

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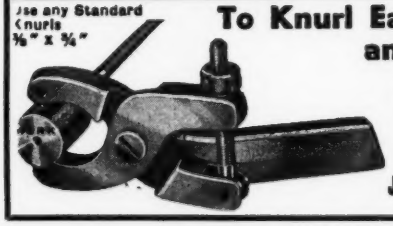

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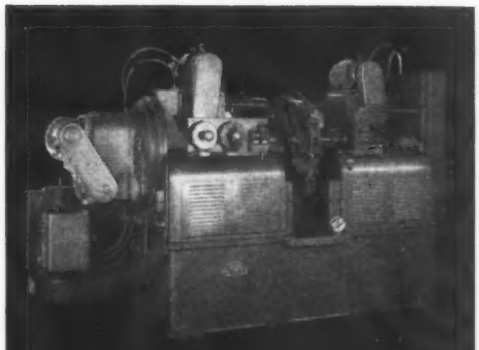

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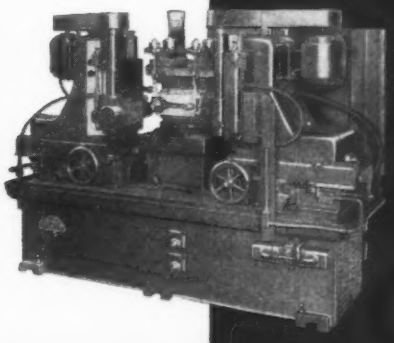
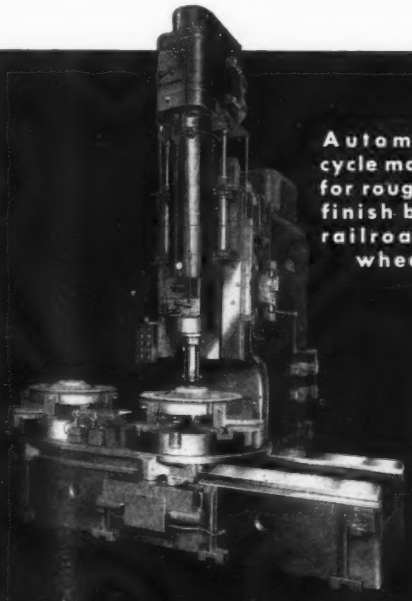
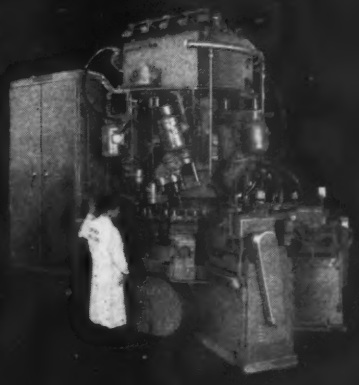


Double-End Connecting Rod Balancing Machine



Automatic-cycle machine for rough and finish boring railroad car wheels



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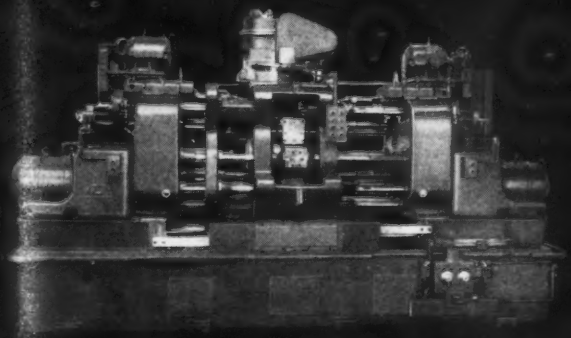
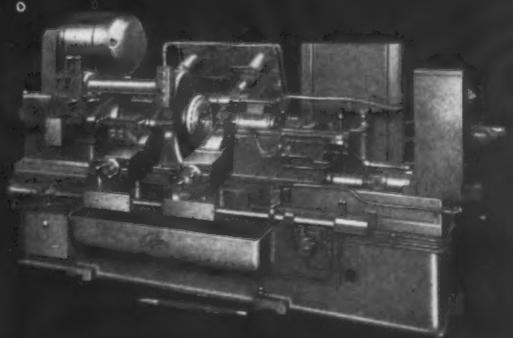


Double End Trunnion Type Machine for drilling, reaming, tapping



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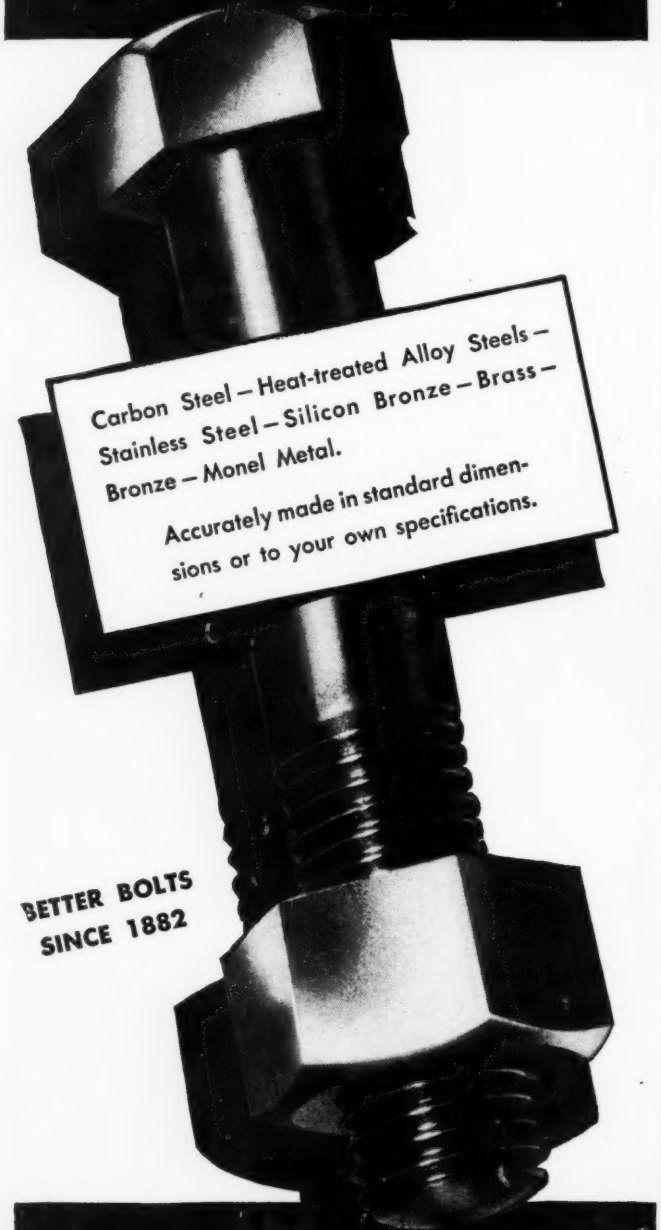

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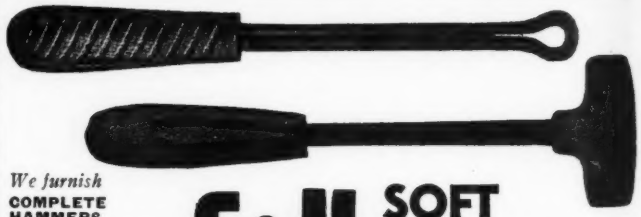

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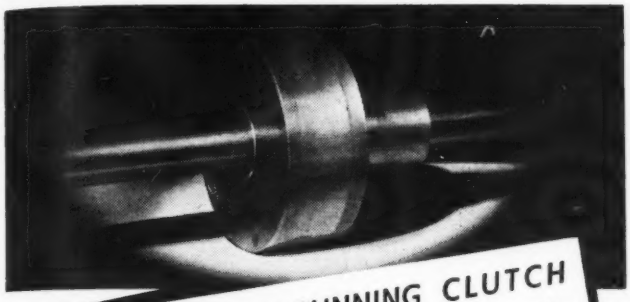

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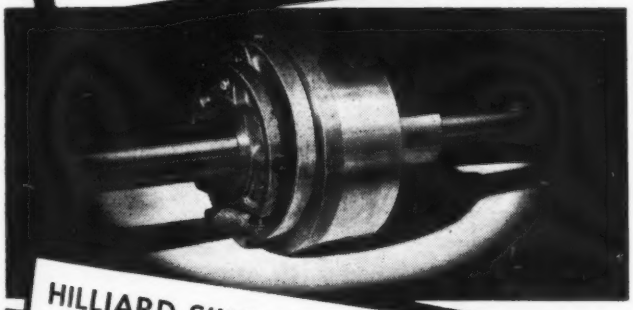

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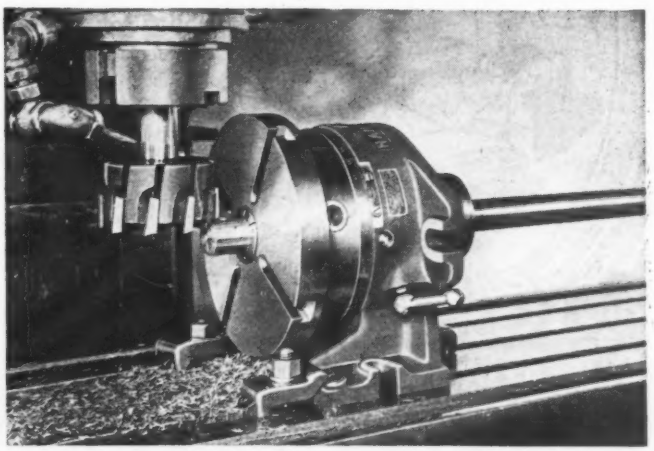

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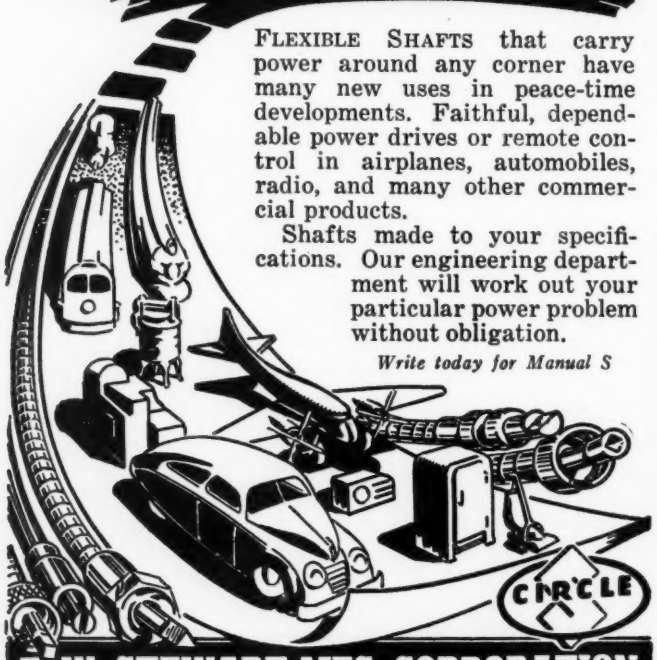

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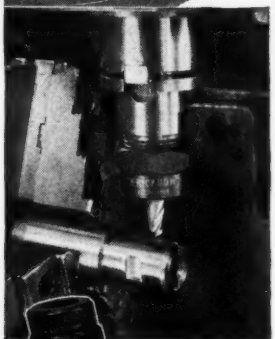

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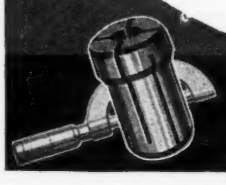
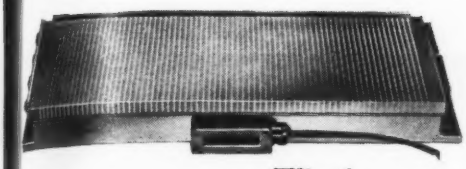


ERICKSON = Collet Chuck Precision



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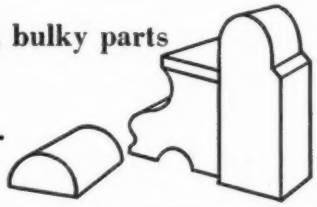
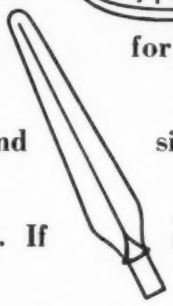
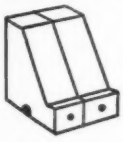
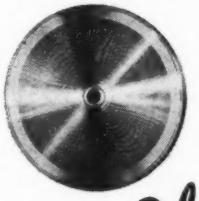


You can increase output by holding many small pieces at one time. You can prevent distortion by holding thin, flat work securely, save the cost of special fixtures  for holding aircraft propeller blades and similar parts with irregular contours. If special segments or fixtures are needed, they are simple and  easily made, but in most cases you'll find that "the best way to hold most work — the only way to hold some of it" is a standard  WALKER CHUCK.

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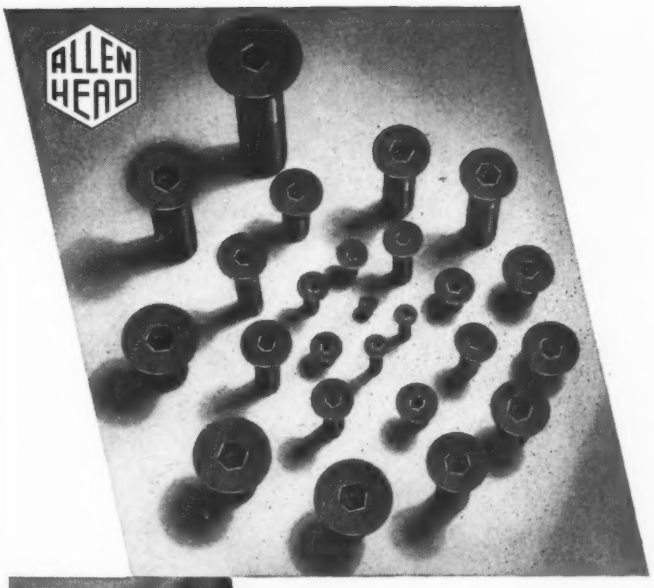

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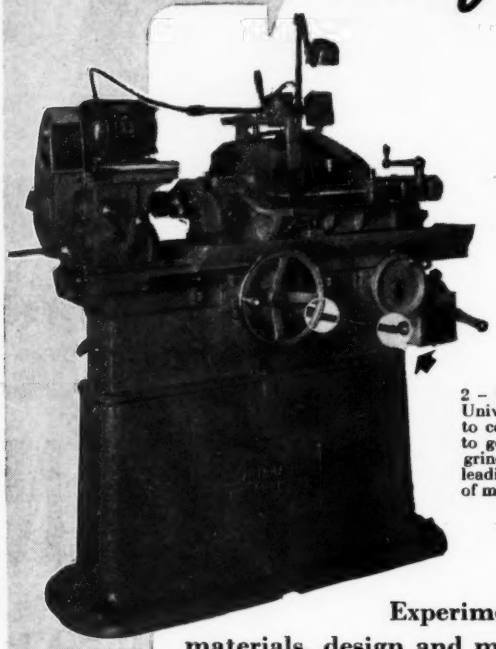

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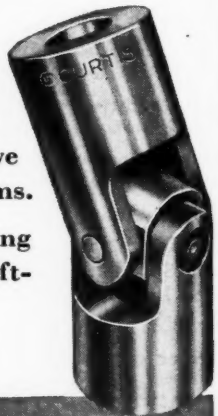

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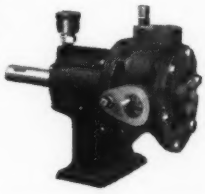

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Many manufacturers throughout the nation have kept their production rolling with bearings supplied by L & S Bearing Company. In addition to specializing in the manufacture of radial, thrust and roller bearings, L & S is a distributor for various other manufacturers of all types of bearings. This two-fold source of supply gives L & S a distinct advantage in helping manufacturers with their bearing problems.

L & S Bearing Company invites an opportunity to help YOU with your bearing requirements. Write us today, listing the quantity, bearing numbers and brands of bearings you need. You will be advised immediately as to the availability of these bearings.

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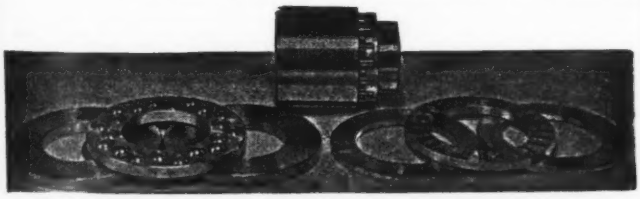
- Greater capacity for heavy duty installations
- Standard sizes and types in stock
- Special sizes to your specifications
- Write for details, outlining your requirements



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- Simplest construction. Resilient cushions suspended between rugged metal jaws.
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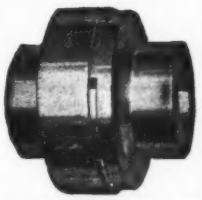
- Extremely quiet.



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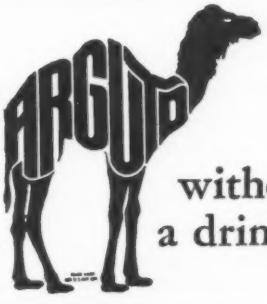

without a drink—

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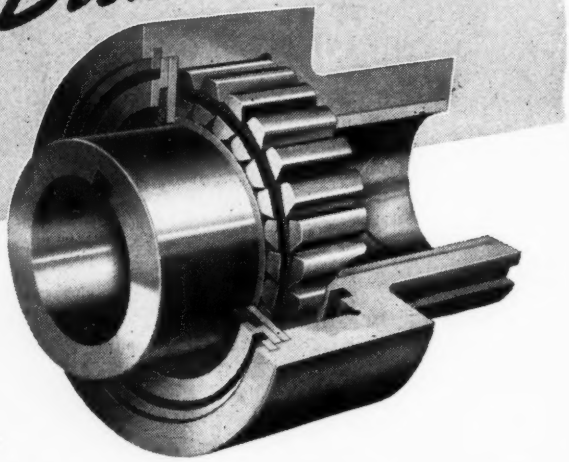
WAYNE JUNCTION PHILADELPHIA

We Ourselves Didn't Realize



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It's really worth investigating if you have, or may have, an application.

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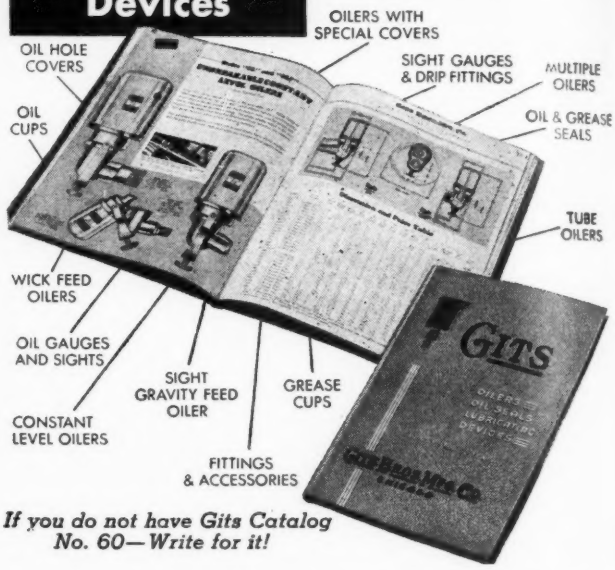

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GITS BROS. MFG. CO.

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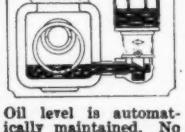

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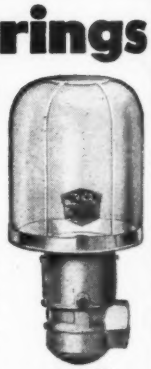

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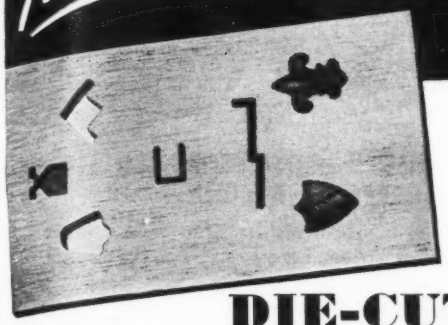

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WITHOUT DRILLING, MILLING OR CHIPPING

• Among the many increasing applications for Disintegrator Drilling is the cutting of shaped holes in hard or soft steel, which is done at a big saving of time and money. The illustration shows a number of irregular holes made by this method. This rapidly developing technique in the field of die-making and its many other uses make the Elox method of Disintegrator Drilling a necessity in the machine shop. Get further details about this modern equipment. Write for literature today.

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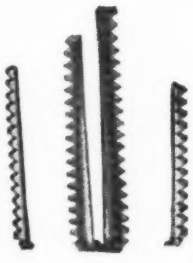

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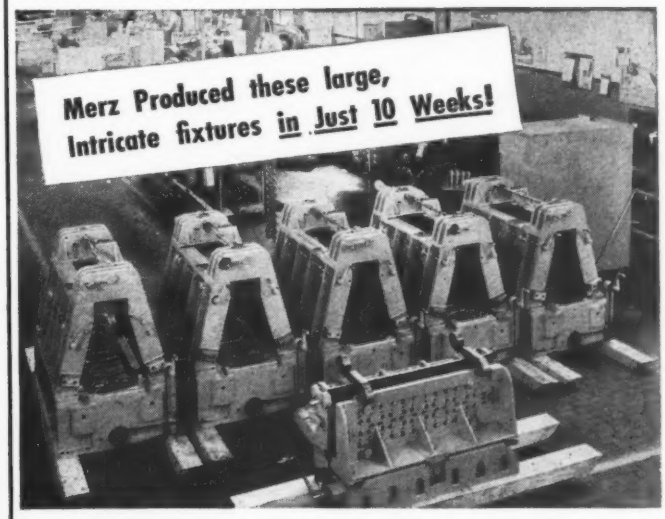

If yours is a problem of obtaining high-precision fixtures or tools—*in minimum time*—here's news! MERZ produced these six intricate drill jigs for horizontal Natco set-ups—complete with patterns, equipment and castings—*in just 10 weeks.* What's more important, these jigs were built to the highest precision standards for drilling, reaming and counter-boring cylinder blocks and drilling and counter-boring an oil pan. This is a typical example of the fast, accurate work being done daily at MERZ —*where speed and precision go hand in hand.* MERZ designs and produces standard A.G.D. and special gages, tools, dies and experimental machines. Write for full information today.

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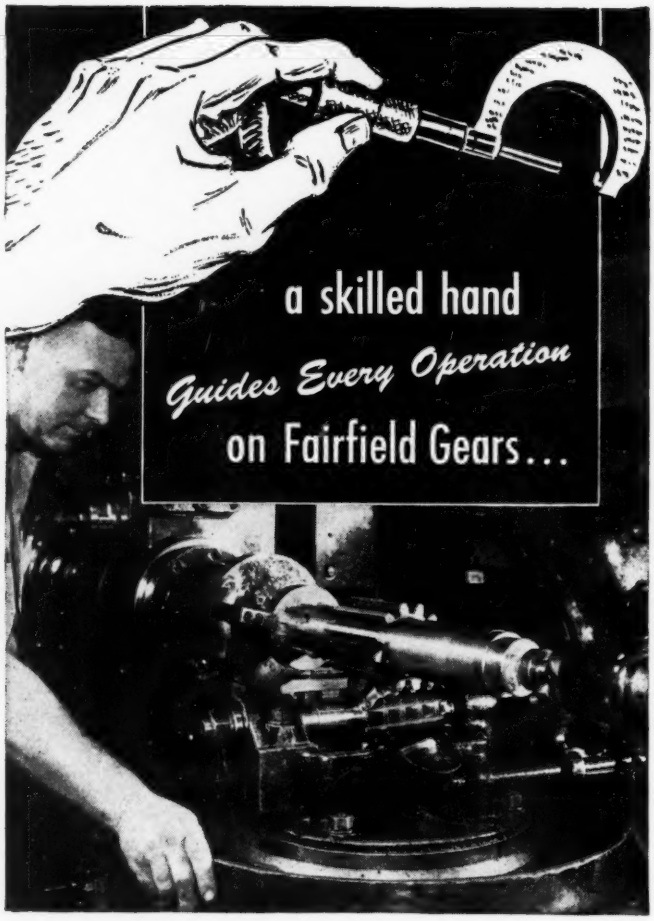

Truly fine gears are the product of manufacturing skill and fine equipment. Fairfield offers both—over 25 years of fine gear-making experience and batteries of modern gear-making machines. Here are complete facilities for making fine gears to order with each operation under the supervision of a skilled craftsman.

Let us go over your gear problems with you. Write for complete information on what Fairfield can do for you.

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G-E FABROIL GEARS for heavy-duty applications consist of compressed cotton fibers held together by steel shrouds and threaded studs.

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CD47-F1

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Geared for Economies
Braun knows the metallurgy and methods that reach rock-bottom cost in the volume production of gears. This knowledge comes from 38 years experience. Often customers' designs and specifications can be safely simplified. Learn what Braun can do for you in reducing costs of gears. Send an inquiry.
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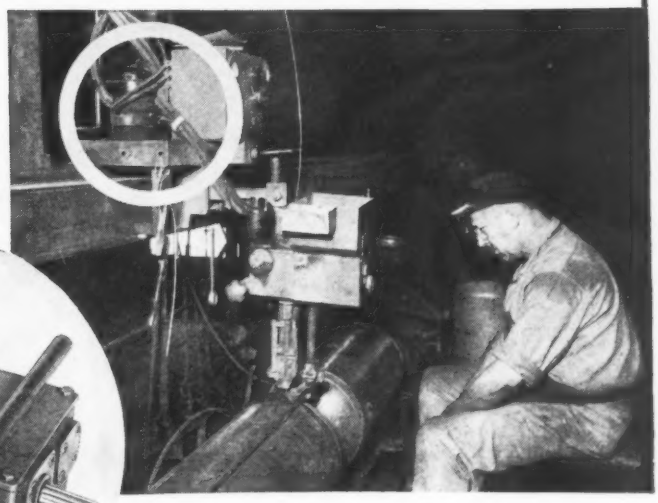
OHIO STOCK SPEED REDUCER

TRANSMITS TRAVEL POWER for

"Lincolnweld"

TRAVEL CARRIAGE and TRACTOR HEAD



Ohio Stock Speed Reducer Number D1 with special attachment case as applied to Lincolnweld automatic travel equipment.

Travel speeds of the Lincolnweld self propelled carriage and tractor heads for automatic welding are dictated by the welding job in hand. Movement must be smooth. Speed must be precision controlled. The entire propulsion unit consists of an electric motor, an attachment case and an Ohio Stock Speed Reducer.

Lincoln Electric Company engineers early recognized the savings possible if a stock reducer could be used in this application. After experimentation the engineers selected an Ohio Stock Gear Reducer.

They found these savings:

1. Heavy tooling expense is avoided.
2. Parts inventory investment is unnecessary.
3. Because it is a stock reducer, cost is lower.
4. Customers are insured quicker replacement, less costly downtime.

. . . and for more than a decade, Lincoln users have continued to profit by these savings which Lincoln has passed on to them.

Ohio Stock Speed Reducers and Gears may offer definite advantages for your product. Check with our engineers today.

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• Bevel Gears with straight or spiral cut teeth—Ellipticals—Herringbones—Helicals—Racks—Spurs—Hypoids—Worms—if you want quality gears economically produced, BILGRAM IS THE ANSWER! Any material, any quantity. Special attention to so-called "difficult" gears. Over 60 years' experience, specially designed equipment and fully modern plant assure satisfaction. Submit your gear problems for economical solution and dependable precision. Estimates gladly furnished.

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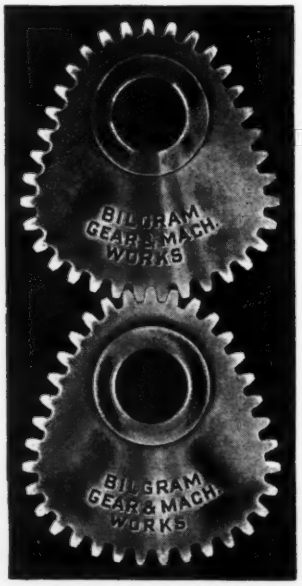
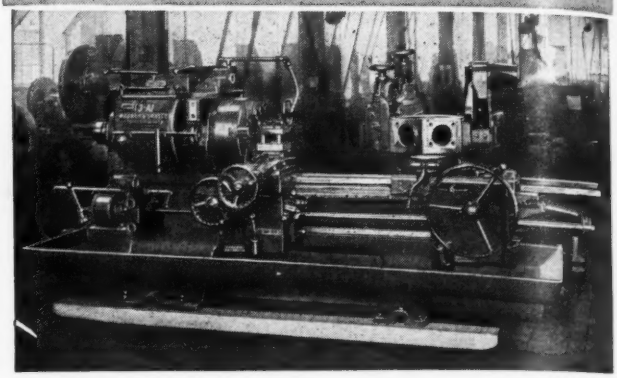


BILGRAM

New Equipment for Post War!



We're tooling up to cut your gears to post-war standards of accuracy . . . and at post-war speed. We've added to our modern equipment (we already have the necessary "know how") to produce gears to your most exacting specifications – and produce them fast!

For spurs up to 72" P.D., 1 D.P. . . . for bevels to 54" P.D., 1 D.P. . . . spirals and helicals to 38" P.D., 2 D.P. . . . worm gears to 48" P.D., 2 D.P. . . . for fabroil, bakelite or rawhide gears in any size . . . for racks to 20' long, 3 D.P. or internals to 25" P.D., 3 D.P. . . . get a Stahl estimate first!

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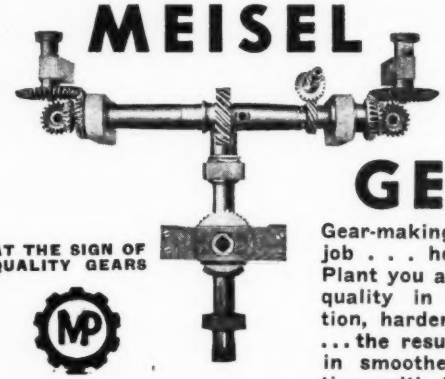

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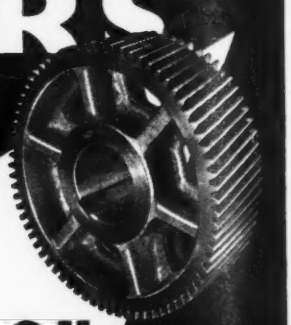
Excellent facilities to fulfill specifications for heat-treated alloy steel Gears . . . Special Gears . . . Special Gear Units . . . Roller-Chain Drives . . . Fabroil and Bakelite Pinions.



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Controlled Atmosphere Hardening INCREASES *Life of* DE LAVAL *Gears*

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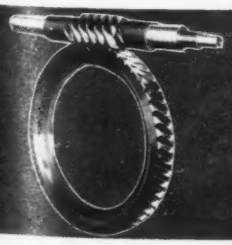
WG-2



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"THEY LIVE ON THE JOB"

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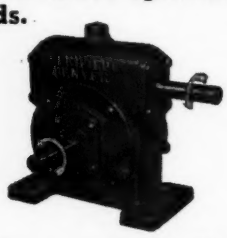
Speed Reducers FROM STOCK

Manufactured in a practical range of sizes and reductions. We also build reducers to meet special needs.



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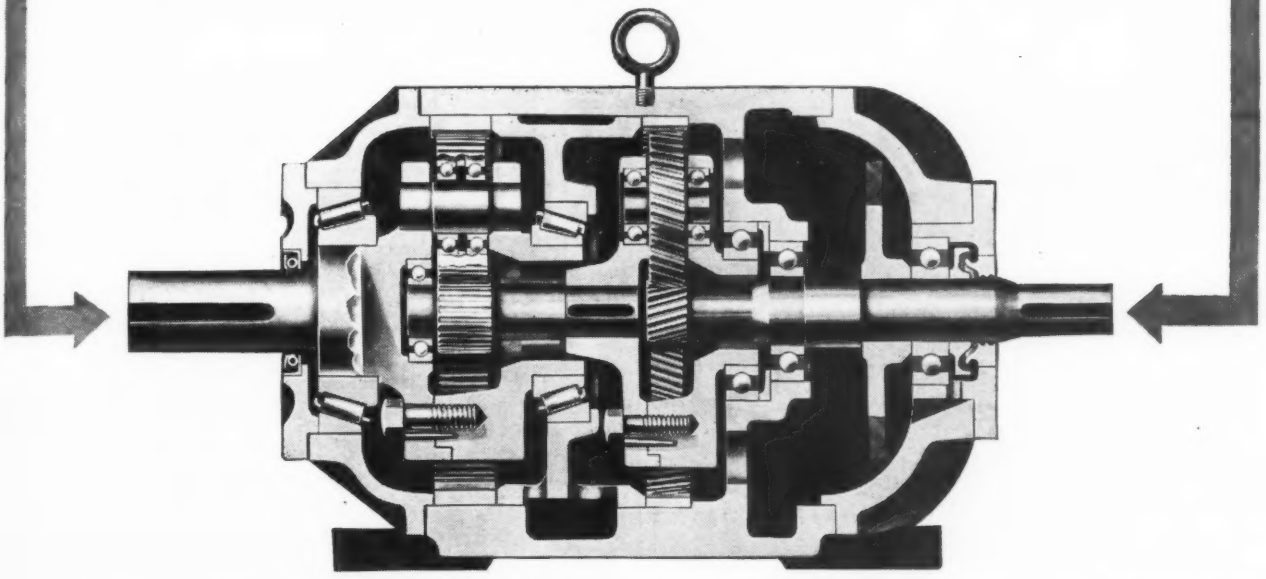
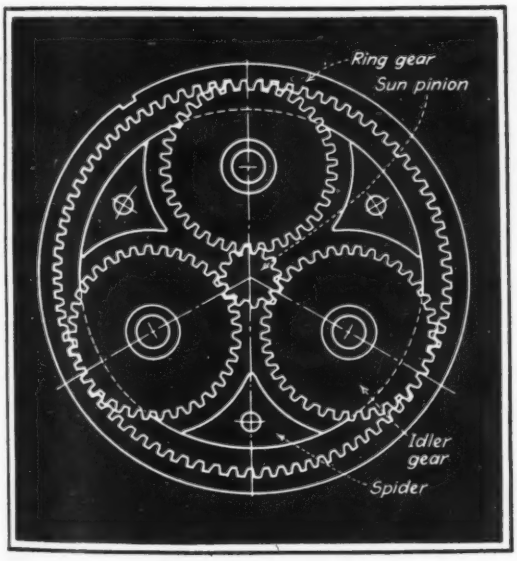


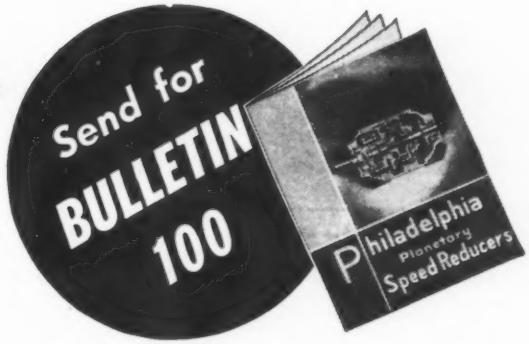
. . . the PHILADELPHIA "PLANETARY" REDUCER



Drawing above shows how sun pinion, idler and ring gears mesh in a planetary system. Gears are of heat treated steel, and mounted entirely on ball or roller bearings. The sun pinions each mesh with three equally spaced idlers, thus reducing pitch line velocity, noise and wear. Gear ratios cover a range of 4 to 1 up to 106 to 1, with sizes up to 100 H.P. Efficiencies as high as 98% are obtained.

This widely used Unit is distinctly superior to the "old spur gear type" Speed Reducer—and has many advantages over parallel shaft reducers. Compactness and ruggedness are inherent in the Planetary form of gearing (see illustrations herewith) – and it is well suited for installations where space is limited—where neat appearance is desired – and where a simple base plate design is preferred; then too, it is very well balanced and neat in appearance.

Also available in Double Reduction Units



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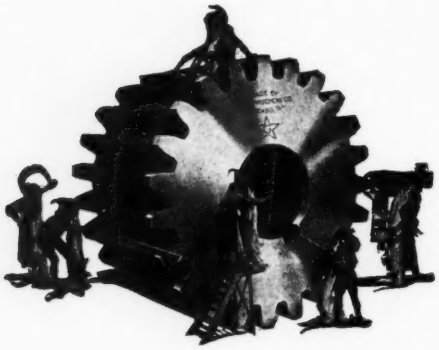

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Better Gear Products

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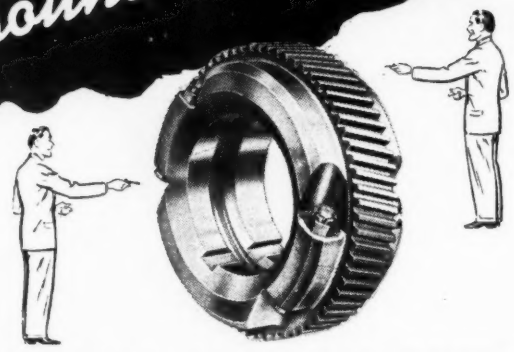
There's a sound reason why



It is common practice in thousands of plants to specify Cincinnati GEARS, GOOD GEARS ONLY. Their precision control, accuracy and performance guarantee assured dependability.

Each Cincinnati Gear is made to fit your particular specifications. It saves time and money and puts the right gear in the right place.

THE CINCINNATI GEAR COMPANY
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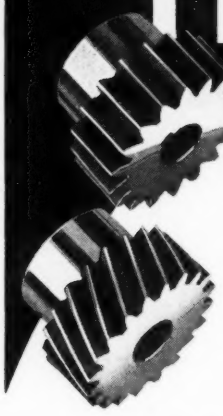

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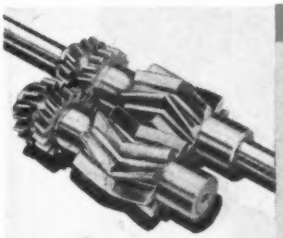

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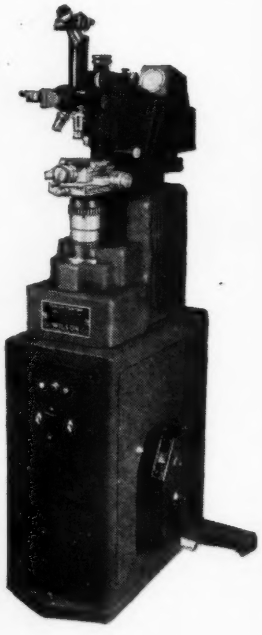

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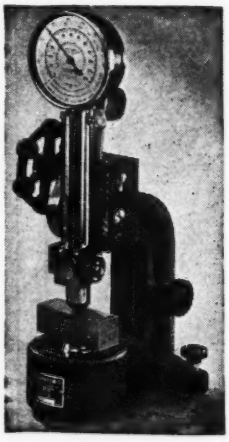

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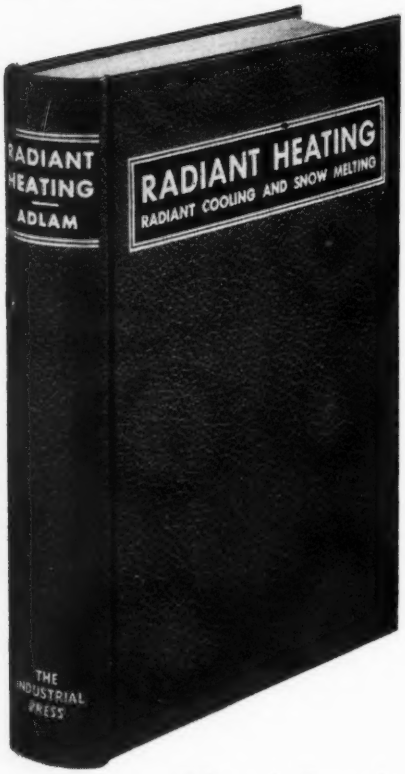

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MR. ADLAM is recognized both in the United States and abroad as an outstanding authority on radiant heating. He was associated with Mr. A. H. Barker when the latter obtained the first patents on radiant heating. Mr. Adlam has had over thirty years' experience with radiant heating in all of its present known phases, including 16 years in the United States.

Mr. Adlam is a member of the American Society of Heating and Ventilating Engineers, the Institution of Heating and Ventilating Engineers, England, the British Institution of Patentees, the exclusive Whitworth Society of Scholars, and is a Fellow of the Royal Society of Arts. During recent years Mr. Adlam has done a lot of pioneeer work in connection with radiant cooling and with snow melting by means of embedded pipes, and has developed special automatic controls for these comparatively new fields of research.

He is at present vice-president and general manager of Sarco Manufacturing Corporation, New York, makers of various types of controls and other heating equipment.

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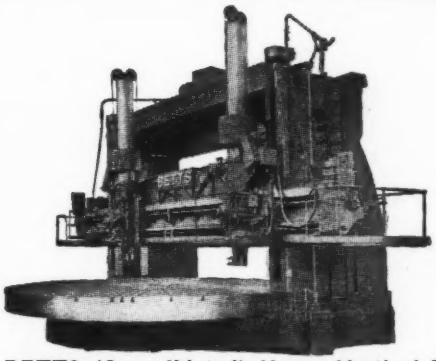
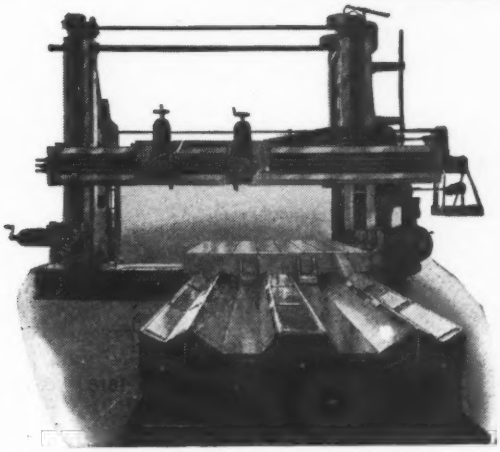
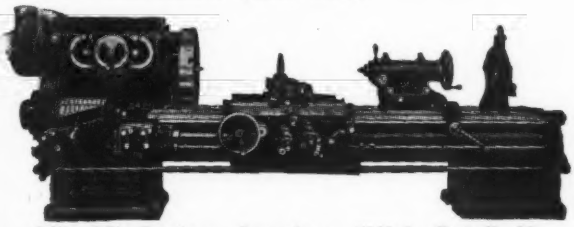


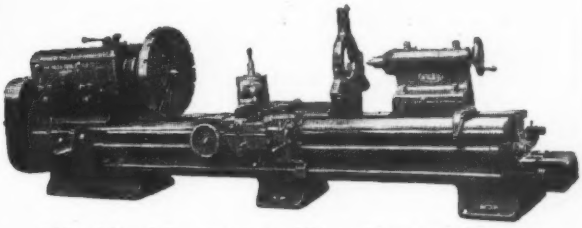
14′ BETTS (Consolidated) Heavy Vertical Boring and Turning Mill, with two swivel heads, arranged motor drive with 40-H.P., 230-V, D.C. motor and control (New 1942).



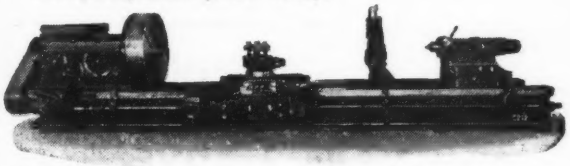
8′6″/14′ x 35′ Detrick & Harvey Convertible Openside Planer, with Three Ways and Double Drive. 100-HP, 230 V, DC Reversing Type Planer Motor and Control. 4-Heads.



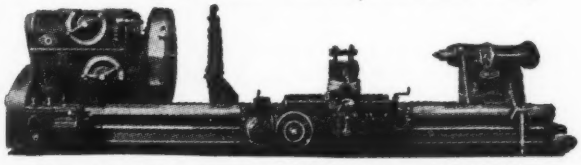
24″ x 26′ Centers American "High Duty" 12-speed geared head Engine Lathe, apron control, PRT, AC, M.D. (New 1942).



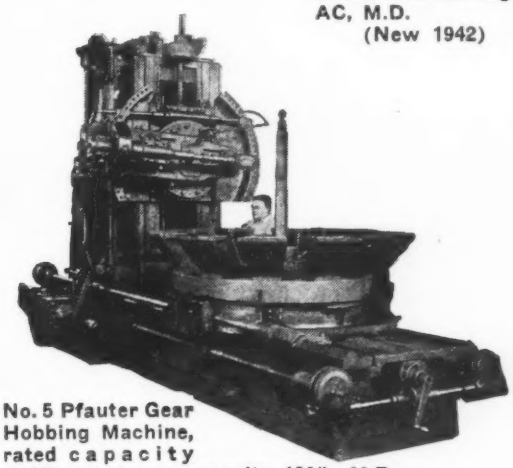
36″ x 32′ (24′ centers), Niles (General Machinery) "TIMESAVER" Engine Lathe. 12-speed geared head, PRT, Taper Attachment to one of the two carriages. AC, M.D. (New 1942)



48″ x 40′ (30′ centers) Simmons Heavy Geared Head Engine Lathe, with two carriages and PRT, 230 V, DC motor and control (New 1942).



48″ x 45′ (35′ centers) Niles (General Machinery) Heavy Engine Lathes. 16-Speed Geared Headstock, Two Carriages with PRT, AC or DC, M.D. (New 1942).
Also available 60″ x 31′ (20′ centers) Niles, 16-Speed G.H. Lathe (New 1942).



No. 5 Pfauter Gear Hobbing Machine, rated capacity 118″; maximum capacity 130″; M.D.

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SIMMONS *Engineered* REBUILDING

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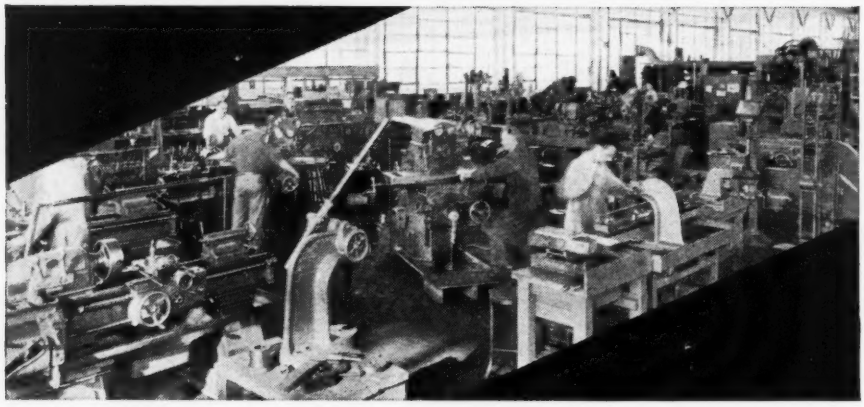

Rebuilt by EXPERTS ONLY—Botwinik Machine Tools Keep Production Up, Costs Down

LATHES

1—Bridgeford 36" x 56', 15 spd., grd. hd., Eng. Lathe, M.D., AC elec. equip., power rap. trav. to carr., compound rest, 2 steady rests, sw. over bed 38", sw. over carr. 26", dist. betw. cens. 48'.

1—Amer. 24" x 12', 12 spd., Eng. Lathe, M.D., sw. over bed 27½", dist. betw. cens. 84".

1—Amer. 20" x 12', Eng. Lathe, act. sw. 26", 2" rising blocks, dist. betw. cens. 90", 12 spd., grd. hd.

1—Hendey 16" x 8', Mod. EBM, Eng. Lathe, 18 speed, taper attmt.

Whitcomb-Blaisdell 20" x 24' and 24" x 10', QCG, DBG, Eng. Lathes, M.D.

Hendey 14" x 6', 16" x 8', 16" x 9', yoke hd., Tool Room Lathes.

Bradford 12" x 6' and Bradford 14" x 6' Lathes. (Brand new—in orig. crates.)

UNIVERSAL MILLERS

1—B. & S. No. 3A Univ. Miller, dbl. overarm, motor in base, tbl. wkg. surf. 55½" x 14", power feed long. 34", cross 12", vert. 19".

1—LeBlond No. 2½ Univ. Miller, tbl. wkg. surf. 41¼" x 10", power feed long. 25", cross 8", vert. 18".

1—Van Norman No. 3 Duplex Miller, high spd. mill. attmt., 12 spds., tbl. wkg. surf. 48¼"x10", power feed long. 32", cross 12", vert. 18⅞".

1—Cin. No. 3 Hi-power Pl. Miller, tbl. wkg. surf. 55¾" x 10½", power feed long. 34", cr. 10", v. 20".

B. & S. No. 2B Pl. Miller, dbl. overarm, Timken bear., motor in base, tbl. wkg. surf. 46¾" x 11¼", auto. power long. 28", cr. 10", v. 19", spin. speeds 21-496.

SHAPERS

(Brand New in Original Crates)

Gemco 24" Univ. Type, power rap. trav.

Steptoe 14" V-Ram Timken bear., forced feed lubrication.

Flather 14" Crank Shaper.

GRINDERS

1—LeBlond No. 2 Univ. Tool & Cutter Grinder, latest type, fully complete, sw. 10", dist. betw. cens. 24".

1—Norton No. 2 Univ. Tool & Cutter Grinder, latest type, fully complete, sw. 12", dist. betw. cens. 28".

B. & S. No. 1 and 2 Univ. Grinders, cens. sw. 10" and 14", dist. betw. cens. 20" and 30".

TURRET LATHES

2—W. & S. No. 3, very latest type, used only 4 mos.—large asstmt. of tools.

W. & S. No. 4 Univ. Turret Lathes, very latest type, pre-selec. hd., hole thru spin. 2-7/16".

3—Simmons No. 2, Dbl. Bk. Grd. Micro Turret Lathes, M.D., spin. spds. 20, range: 44-750 and can be increased, sw. over bed 14", cross sl. 6", effec. turn. move. at 1 setting on the bed 6".

1—W. & S. No. 2A Univ. Turret Lathe, latest type, Timken bear., cov. ways, hole thru spin. 3⅞".

2—Amer. 4' 12" col. Trip. Pur. Pl. Radial Drill, M.D., 24 spin. speeds, No. 5 Morse Taper.

2—Cin.-Bick. 5' 13" col. Pl. Radial Drill, M.D., 24 spin. speeds, No. 5 Morse Taper

1—Cin.-Bick. 6' 15" col. Pl. Radial Drill, M.D., 24 spin. speeds, No. 5 Morse Taper.

THIS IS ONLY A PARTIAL LIST OF OUR HUGE STOCK OF QUALITY NEW, USED AND REBUILT MACHINE TOOLS. WRITE, WIRE OR PHONE.

BOTWINIK BROTHERS of MASS., INC.

14 SHERMAN STREET — WORCESTER (1), MASS.

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Nos. 1 & 5A Lees Bradner
Nos. 3 & 12 Barber Colman
No. 130 Cleveland vertical
Nos. 8H, 12H & 16H8 Gould & Eberhardt

GRINDERS

6"x18", No. 10 B. & S. Elec. Hydraulic
No. 13 Brown & Sharpe univ. tool
No. 3 Abrasive surface
16" No. 10 Blanchard rotary surface
16" & 24", No. 25A Heald rotary surface

ENGINE LATHES

14"x6' Hendey toolroom
14"x6' & 16"x6' American
16"x8' Springfield
22"x96" centers Monarch
36"x16' Bridgeford

TURRET LATHES

Nos. 3 & 5 Jones & Lamson univ.
Nos. 4 & 5 Warner & Swasey univ.
Nos. 5 & 3B Foster universal
Nos. 3, 4 & 5 Gisholt universal
42" Bullard "New Era" vertical

MILLERS

Nos. 2H, 3H & 4H Kearney & Trecker vert.
No. 4 Cincinnati high power vertical.
12" & 18" Cincinnati plain mfg.
Nos. 4-36, 4-48, 5-48 & 5-60 Cincinnati hydromatic
No. 2-20 Kent Owens hydraulic

PRESSES

12 ton US OBI
No. 10 Bliss straight side, grd.
35 ton No. 2 Standard screw type
1000 ton Lake Erie hydraulic

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Graduate Mechanical Engineer having 5 years experience on original design electro mechanical small apparatus or instruments. Supervising experience secondary to ability to work out original designs. In answer, include educational and experience details and salary requirements. Box No. 415, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

WANTED—TO BUY

TOOLROOM LATHE—Late Model
13" swing 6 ft. bed

WET SURFACE GRINDER
12" x 24" or 36" table
14" dia. wheel, for sharpening dies

GENERAL TRANSFORMER CORPORATION
1250 West Van Buren St. Chicago 7, Illinois

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A mechanical designer having had layout experience on small electro mechanical apparatus. Engineering degree desirable but secondary to ability to originate and work out mechanical devices. In answer include educational and experience details and salary requirements. Box No. 416, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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4—Cleveland Worm Gear Double Reduction Units, Size 073D, Series 12D. Ratio 2340:1. 27,100 in. lbs. torque, Class 5 Link Belt Pillow Blocks. Used, excellent condition.

1—Link Belt, Size DWVT/50 RH Speed Reducer. Input 465 RPM. Output 1.39 RPM. Input H.P. .266. Output torque 7,360 in. lbs. Ratio 342. Service Factor 1. Horizontal Drive Shaft with flat belt pulley. Vertical downward driven shaft. Excellent drive for agitator. Used, good condition.

1—Oliver Universal Tool and Cutter Grinder. Capacity:—Face Mills up to 15" in diameter. Maximum distance between centers—15". Swing of centers, 8". Cross Table travel, 8". Angular adjustment of spindle head, 180 degrees. Angular adjustment of carriage, 180 degrees. Longitudinal adjustment of table, 10". Maximum horizontal travel grinding unit, 10". Equipment: —(Complete list upon request). ½ H.P. Howell 220/440 volts, 60 cycles, 3 phase, 3450 RPM motor with Square D magnetic starter. New.

2—Hydreco Model NGA, 220-15 Oil Pumps rated for pressures up to 1000 PSI; complete with 15 gal. tank with gage glasses, direct connected to 10 H.P. Fairbanks Morse open ball bearing 220/440 volts, 60 cycle, 3 phase, 1170 RPM motors, mounted on common base. For hydraulic pressure service. New.

800-900 ft. 35-15 Chrome nickel heat and corrosion resisting conveyor chain, 9½" pitch. Sprockets, shafts, pillow blocks, chain guides and takeups included. Sketch on request. Used, excellent condition.

30—No. 779 Hauck Manual Proportioning Oil Burners, complete with filter, pressure regulator, pressure gage, shutoff valve and mounting plate but without refractory ignition tile. Used, good condition.

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Tool Engineering

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Planer Type Miller, Ingersoll or Cincinnati —72" x 60" x 20', AC or DC. Must be modern.

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18 Ward St. Rochester, N. Y.

WANTED

1—No. 5 Cincinnati Vertical Milling Machine
1—28" Shaper
1—18" or 24" Traveling Head Shaper
1—36" x 12 or 14' Planer, 4 heads.
All of this equipment must be modern and in first class condition.

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VERY LOW PRICE on this powerful high production lathe. 60" centers; geared head; 9 speeds on carriage, 6 speeds on spindles; 8 tools and cross slides; 5 h.p. 3 ph. AC motor; hardened steel ways and gears. For work on heavy steel forgings; does several operations at one time. JAY SALTER, 306 Rosedale Street, Rochester, N. Y.

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Carborundum Co.
Walls Sales Corp.

ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, POLISHING
Carborundum Co.
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Baldwin Locomotive Works
Bethlehem Steel Co.
Elmes Engineering Works
Farquhar, A. B., Co.
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Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
Watson-Stillman Co.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOYS FOR DIES
National Lead Co.

ALLOY-STEELS
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Div.)
Carpenter Steel Co.
Chambersburg Engineering Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Republic Steel Corp. (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.
Wyckoff Steel Co.

ALLOYS, ALUMINUM
Aluminum Co. of America

ALLOYS, NON-FERROUS
American Brass Co.

ARBOR PRESSES
See Presses, Arbor.

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Brown & Sharpe Mfg. Co.
Cleveland Twist Drill Co.
Danly Machine Specialties, Inc.
Hannifin Mfg. Co.
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Kempsmith Mch. Co.
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Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

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Bunting Brass & Bronze Co.
Cramp Brass & Iron Fdrs. Div.
Johnson Bronze Co.
Ryerson, Joseph T., & Son, Inc.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co.
Gisholt Machine Co.
Norton Co.
Pope Machinery Corp.
Sundstrand Mch. Tool Co.

BALLS, Brass, Steel, Etc.
Gwilliam Co.
S K F Industries, Inc.

BARS, Boring
See Boring Bars.

Phosphor Bronze
Bunting Brass & Bronze Co.
Johnson Bronze Co.

Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp
Jones & Laughlin Steel Corp.
Republic Steel Corp. (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Ward Steel Co.
Wheelock, Lovejoy & Co.

BASES, Machinery, Welded
Mahon, R. C., Co.

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Bunting Brass & Bronze Co.
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Ball & Roller Bearing Co.
Bantam Bearings Div.
Bearings Co. of America
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Equitable Bearing Co., Inc.
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After months of careful research and actual production tests, Lempco is now ready to offer you the best adjustable chucking reamer ever made. It is made in two styles. Model C has a straight shank. Model CT has a tapered shank.

The new Lempco Reamer can be used in place of any standard reamer without changing set up. They will produce a smooth finish even when used to finish holes with keyways, slots, oil grooves or other interruptions.

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Hydraulic Press Mfg. Co.
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Modern Tool Works
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New Britain-Gridley Mch. Div., New Britain Machine Co.
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Elastic Stop-Nut Corp. of America
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Industrial Press
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Barnes Drill Co.
Barnes, W. F., & John, Co.
Bullard Company
Cochrane-Bly Co.
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Cincinnati Planer Co.
Cosa Corp.
Jones Machine & Tool Works, Inc.

"Not only to serve today, but to anticipate tomorrow"

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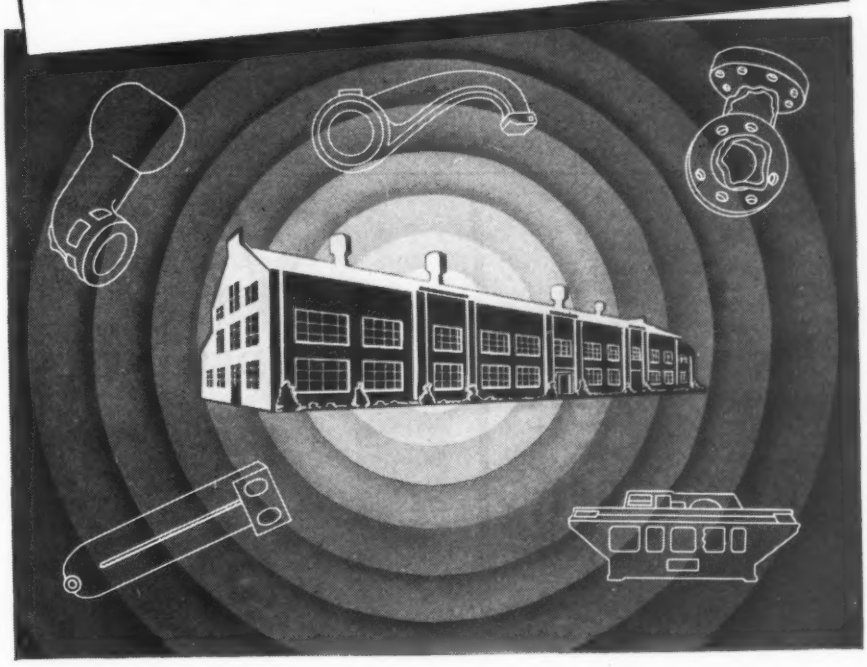

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ABSCO Controlled Castings offer to design engineers and to production executives — ferrous and ferrous alloy parts that are cast to close tolerances and produced under strict control. These tolerances are much closer, this control is far stricter because of the centralized research and engineering facilities with which American Brake Shoe Company backs its foundries.

A complete metallurgical department to develop the proper metal for your specific application . . . a fully-equipped experimental foundry to pilot difficult jobs — these are parts of a research and engineering center serving every user of Absco castings.

No matter whether the best castings for your purpose prove to be Meehanite, ABK Metal or a controlled Gray Iron alloy . . . no matter whether your Absco castings are produced at our foundries in Mahwah, N. J., Melrose Park, Ill., or Baltimore, Md., you benefit from the skill, knowledge and equipment at the disposal of Brake Shoe's technical, engineering and foundry production personnel.

Write us detailing the performance conditions under which the castings you use are to serve. Let us tell you then how centralized research can put close control of castings to work for you.

AMERICAN Brake Shoe COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 PARK AVE., NEW YORK 17, N. Y.

4748

BORING BARS
Armstrong Bros. Tool Co.
Bullard Company
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gisholt Machine Co.
McCrosky Tool Corp.
Ready Tool Co.
Scully-Jones Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BORING, DRILLING AND MILLING MACHINES, Horizontal
Barnes, W. F., & John, Co.
Cochrane-Bly Co.
Cross Co.
Firth-Sterling Steel Co.
Giddings & Lewis Mch. Tool Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Lucas Mch. Tool Co.
Moline Tool Co.
National Automatic Tool Co.
Ohio Machine Tool Co.
Sommer & Adams Co.
Universal Boring Machine Co.

BORING HEADS
Ex-Cell-O Corp.
Gairing Tool Co.
McCrosky Tool Corp.

BORING HEADS, Offset
Gairing Tool Co.

BORING MACHINES, Diamond and Carbide Tool
Ex-Cell-O Corp.
Heald Machine Co.
National Automatic Tool Co.
Stokerunit Corp.

BORING MACHINES, Jig
Bryant Machinery & Engineering Co.
Cincinnati Bickford Tool Co.
Cochrane-Bly Co.
Fosdick Machine Tool Co.
Kearney & Trecker Products Corp.
Machinery Mfg. Co.
Moore Special Tool Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Triplex Machine Tool Corp.

BORING TOOLS
Armstrong Brothers Tool Co.
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gisholt Mch. Co.
Haynes Stellite Co.
Jones & Lamson Mch. Co.
Kennametal, Inc.
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
O.K. Tool Co., Inc.
Ready Tool Co.
Scully-Jones & Co.
Slocomb, J. T., Co.
Union Twist Drill Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BRAKES, Press and Bending
Bliss, E. W., Co.
Cincinnati Shaper Co.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
Warren City Mfg. Co.
Watson-Stillman Co.

BROACHES
American Broach & Mch. Co.
Carboloy Co., Inc.
Colonial Broach Co.
Detroit Broach Co.
Ex-Cell-O Corp.
Lapointe Machine Tool Co.
National Broach & Mch. Co.

BROACHING MACHINES
American Broach & Mch. Co.
Cincinnati Milling Mch. Co.
Colonial Broach Co.
Consolidated Mch. Tool Corp.
Foote-Burt Co.
Lapointe Machine Tool Co.
National Broach & Mch. Co.
Oilgear Co.

BRONZE
American Brass Co.
Ampco Metal, Inc.
Bunting Brass & Bronze Co.
Cramp Brass & Iron Foundries Div.
Delta Manufacturing Co.
Jefferson Machine Tool Co.
Johnson Bronze Co.
Shook Bronze Co.

BUFFERS
Bridgeport Safety Emery Wheel Co., Inc.
Delta Mfg. Div. Rockwell Mfg. Co.
Gardner Machine Co.
Production Machine Co.
Rotor Tool Co.

BULLDOZERS
Ajax Manufacturing Co.
Baldwin Locomotive Works
Chambersburg Engineering Co.
Hannifin Mfg. Co.
Lake Erie Engineering Corp.
Watson-Stillman Co.

BURNISHING MACHINERY
Baird Machine Co.

BUSHINGS, Brass, Bronze, Etc.
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Boston Gear Works, Inc.
Bunting Brass & Bronze Co.
Haynes Stellite Co.
Johnson Bronze Co.

Hardened
Baumbach, E. A., Mfg. Co.
Danly Machine Specialties, Inc.
Leland-Gifford Co.
U. S. Steel Co., Inc.

Jig
Ampco Metal, Inc.
Colonial Broach Co.
Ex-Cell-O Corp.
Universal Engineering Co.

CABINETS, Tool
Armstrong Brothers Tool Co.

CALIPERS
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

CAM CUTTING MACHINES
Frew Machine Co.
Pratt & Whitney Co.

CAM MILLING AND GRINDING MACHINES
Cochrane-Bly Co.
Rowbottom Machine Co.

CAMS
Hartford Special Mchry. Co.
Kux Machine Co.
Rowbottom Machine Co.
Vinco Corporation

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Firth-Sterling Steel & Carbide Corp.
Kennametal, Inc.
Metal Carbides Corp.
Vanadium Alloys Steel Co.

CASE-HARDENING
Pittsburgh Gear & Machine Co.
Williams, J. H., & Co.

CASE-HARDENING FURNACES
See Furnaces, Heat Treating.

CASTINGS
Aluminum, Brass, Bronze, Magnesium, Etc.
Aluminum Co. of America
Ampco Metal, Inc.
Bethlehem Steel Co.
(Brass and Bronze only)
Bunting Brass & Bronze Co.
Cramp Brass & Iron Foundries Div.

Die
Aluminum Co. of America
American Brass Co.
Madison-Kipp Corporation
Veeder-Root, Inc.

Gray Iron
Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
Union Mfg. Co.

Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp.
American Brake Shoe Co.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Cramp Brass & Iron Foundries Div.
Lebanon Steel Foundry.
Meehanite Metal Corp.

CEMENT, Disc Grinding Wheel
Besly, Chas. H., & Co.
Carborundum Co.

HIGH *Production*

CONTINUOUS OIL GROOVING

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

500 PIECES PER HOUR!

The operator loads and unloads the work *without stopping the Machine*—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8"; grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO
CONTINUOUS OIL GROOVER

SINCE 1868 THE WICACO MACHINE CORPORATION
WAYNE JUNCTION PHILADELPHIA 44, PA.

Gardner Machine Co.
Hendey Machine Co.
Walls Sales Corp.

CENTERING MACHINES
Consolidated Mch. Tool Corp.
Cross Co.
Hanson-Whitney Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

CENTERS

Lathe
Carboloy Co., Inc.
Firth-Sterling Steel & Carbide Corp.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
Scully-Jones & Co.
Standard Tool Co.

Planer & Miller
Cincinnati Planer Co.

CHAIN DRIVES
Morse Chain Co.

CHAINS, Power Transmission and Conveyor
Boston Gear Works, Inc.
Philadelphia Gear Works

CHAMFERING MACHINES, Gear Tooth
Bilgram Gear & Mch. Works
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Lipe-Rollway Corp.

CHARTS, MEASUREMENT
Capell Engrg. Co.

CHISELS AND CHISEL BLANKS
Bethlehem Steel Co.

CHUCKING MACHINES
Baird Machine Co.
Bardons & Oliver, Inc.
Bliss, E. W., Co.
Bullard Company
Cleveland Automatic Machine Co.
Gisholt Machine Co.
Goss & DeLeeuw Mch. Co.
Heald Machine Co.
Jones & Lamson Machine Co.
National Acme Co.
New Britain-Gridley Mch. Div.
Potter & Johnston Mch. Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

Multiple Spindle
Goss & DeLeeuw Mch. Co.
National Acme Co.
New Britain-Gridley Mch. Div.

CHUCKS

Air Operated
Anker-Holth Mfg. Co.
Hannifin Mfg. Co.
Logansport Machine Co., Inc.
Schrader's Son, A.
Skinner Chuck Co.
Union Mfg. Co.

Collet or Split
See Collets.

Diaphragm
Van Norman Co.

Drill
Cleveland Twist Drill Co.
Erickson Tools Div., Erickson Steel Co.
Ettco Tool Co.
Jacobs Mfg. Co.
Lee, K. O., & Son Co.
McCrosky Tool Corp.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.
Standard Tool Co.
Union Mfg. Co.

Full Floating
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Gisholt Mch. Co.
Scully-Jones & Co.

Lathe, Etc.
Anker-Holth Mfg. Co.
Bullard Company
Cushman Chuck Co.
Erickson Tools Div., Erickson Steel Co.
Gisholt Mch. Co.
Jones & Lamson Mch. Co.
Rivett Lathe & Grinder, Inc.
Scherr, George, Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.
Warner & Swasey Co.

Magnetic
Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Hanchett Mfg. Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

Quick Change and Safety
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Lee, K. O., & Son Co.
McCrosky Tool Corp.
Modern Tool Works
Procunier Safety Chuck Co.
Scully-Jones & Co.

Ring Wheel
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

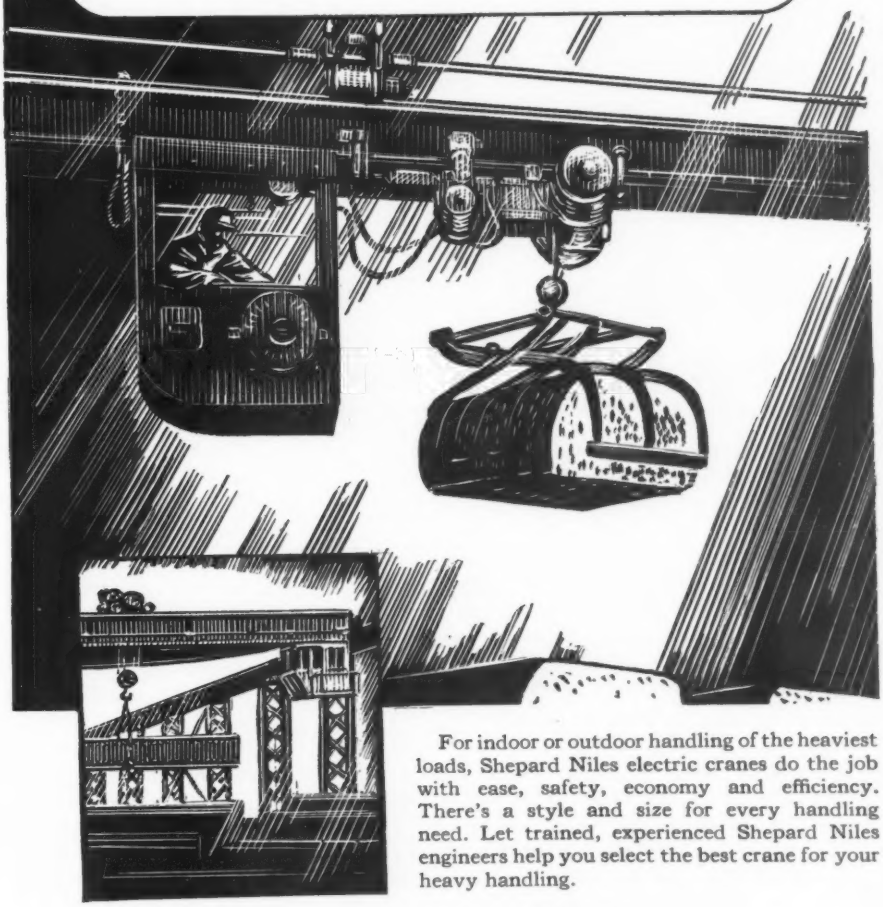
Tapping
Barber Colman Co.
Erickson Tools Div., Erickson Steel Co.
Errington Mechanical Laboratory
Greenfield Tap & Die Corp.
Jacobs Mfg. Co.

Need A Railroad In Your Plant?

When you install a Shepard Niles monorail hoist you have your own private railroad to lift heavy loads, move them to other parts of the plant and deposit them where needed.

America's oldest builder of electric hoists and cranes has a style and size of monorail hoist for every handling operation from 1/8 to 20 tons. Trained, experienced Shepard Niles engineers will gladly survey your material handling problems and recommend, without obligation, the best style of monorail hoist to do the job. With over 5,000 styles and sizes from which to choose, there's bound to be one to suit you.

Shepard Niles monorail hoists, whether floor or cab operated, work economically and efficiently, year after year. When a Shepard Niles does the work there's no tired muscles, no absenteeism.



For indoor or outdoor handling of the heaviest loads, Shepard Niles electric cranes do the job with ease, safety, economy and efficiency. There's a style and size for every handling need. Let trained, experienced Shepard Niles engineers help you select the best crane for your heavy handling.

Shepard Niles
CRANE & HOIST CORPORATION
444 SCHUYLER AVE., MONTOUR FALLS, N. Y.

McCrosky Tool Corp.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.

CIRCUIT BREAKERS
General Electric Co.

CLAMPING APPLIANCES FOR MACHINE TOOLS
Standard Shop Equipment Co., Inc.

CLAMPS
Armstrong Brothers Tool Co.
Baumbach, E. A., Mfg. Co.
Besly, Chas. H., & Co.
Brown & Sharpe Mfg. Co.
Danly Machine Specialties, Inc.
Standard Shpp. Equipment Co., Inc.
Starrett, L. S., Co.
Williams, J. H., & Co.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div.
Oakite Products, Inc.

CLUTCHES
Barnes Drill Co.
Clearing Mch. Corp.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Formsprag Co.
Hilliard Corp.
Johnson, Carlyle, Machine Co.
Lipe-Rollway Corp.
Morse Chain Co.
Rockford Clutch Div.
Twin Disc Clutch Co.

COATINGS, PROTECTIVE
Bakelite Corp.
Bullard Co., Bullard-Dunn Process Div.

COLLARS, Safety
Standard Pressed Steel Co.

Spacings, Etc.
Scully-Jones & Co.

COLLETS
Ames, B. C., Co.
Anker-Holth Mfg. Co.
Brown & Sharpe Mfg. Co.
Cleveland Twist Drill Co.
Erickson Tools Div., Erickson Steel Co.
Gisholt Mch. Co.
Hannifin Mfg. Co.
Hardinge Brothers, Inc.
Jones & Lamson Mch. Co.
Modern Tool Wks.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Scully-Jones & Co.
Standard Tool Co.
Stark Tool Co.
Union Twist Drill Co.
Universal Engineering Co.
Warner & Swasey Co.

COMPARATORS—
See Gages, Comparator.

COMPARATORS, Screw Thread
Bausch & Lomb Optical Co.
Jones & Lamson Mch. Co.
Scherr, George, Co., Inc.
Triplex Machine Tool Corp.

COMPOUNDS

Cleaning
Oakite Products, Inc.

Cutting, Grinding, Metal Drawing, Etc.
Gulf Oil Corp.
National Broach & Mch. Co. (Broaching and Lapping)
Oakite Products, Inc.
Shell Oil Co., Inc.
Standard Oil Co., (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Resin or Molding
Bakelite Corp.
General Electric Co.

COMPRESSORS, Air
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.

CONTRACT WORK
Adams Stamping Co.
Bliss, E.W., Co.
Columbus Die, Tool & Mch. Co.
Diefendorf Gear Corp.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Hill Acme Co.
Jack & Heintz Precision Industries, Inc.
Kaydon Engrg. Corp.
Langelier Mfg. Co.
LeBlond, R.K., Mch. Tool Co.
Mummert-Dixon Co.
National Acme Co.
Rockford Machine Tool Co.
Taft-Peirce Mfg. Co.
U. S. Tool Co., Inc.
Wicaco Machine Corp.

CONTROLLERS
Allen-Bradley Co.
Bristol Co.
Clark Controller Co.
General Electric Co.

COUNTERBORES
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Continental Tool Works Div.
Ex-Cell-O Corporation
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Genesee Mfg. Co., Inc.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Starrett, L. S., Co.
Union Twist Drill Co.

COUNTERSHAFTS
LeBlond, R. K., Mch. Tool Co.
Standard Pressed Steel Co.
Warner & Swasey Co.

COUNTERSINKS
Ex-Cell-O Corp.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Scully Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

COUNTERS, Revolution
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

COUNTING DEVICES
Starrett, L. S., Co.
Veeder-Root, Inc.

COUPLINGS

Flexible
Boston Gear Works, Inc.
Eberhardt-Denver Co.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Industrial Machine Works, Inc.
James, D. O., Mfg. Co.
Lovejoy Flexible Coupling Co.
Morse Chain Co.
Philadelphia Gear Works

Pipe, Tubes, Etc.
Dart, E. M., Mfg. Co.

Shaft
Boston Gear Works, Inc.
Foote Bros. Gear & Machine Corp.
Hilliard Corp.
Standard Pressed Steel Co.

CRANES, Electric Traveling
Morgan Engineering Co.
Shepard Niles Crane & Hoist Corp.

Hand Traveling
Shepard Niles Crane & Hoist Corp.

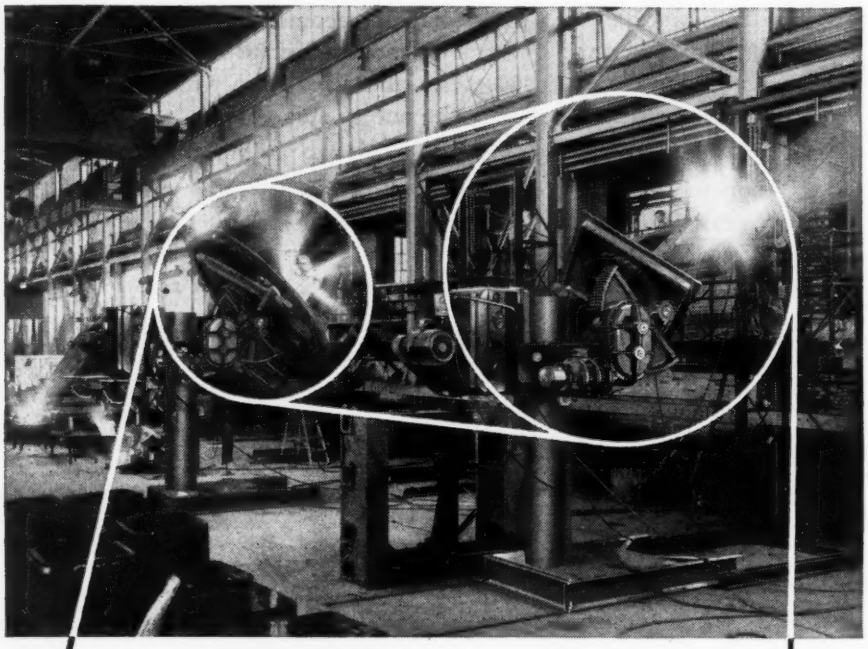
Locomotives
Cullen-Friestedt Co.
Hill Acme Co.

Portable
Canedy-Otto Mfg. Co.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg. Co.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Michigan Tool Co.
Morse Twist Drill & Mch. Co.
National Broach & Mch. Co. (Gear Shaper)
National Twist Drill & Tool Co.
O.K. Tool Co., Inc.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Waltham Mch. Wks.

Milling
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
Columbus Die, Tool & Machine Co.



More WELDING going on here.....

• More welding and less time spent in flopping, propping up and crawling around weldments is the end result of the C-F Positioners in this welding department.

Mounted on C-F Welding Positioners, weldments can be quickly brought into position for a downhand pass—better, more uniform welds with resulting economies and production increases follow. Welders spend more time welding when they work with C-F Positioners because one "set-up" on the table allows them to maneuver the job without assistance, whether hand or power operated Positioners are used.

Power operated, variable speed C-F Positioners, with table rotation speeds in any range from 0 RPM and up, coupled with table tilt to 135° from the horizontal make them the logical choice for any production welding operation. Like all C-F Positioners, they have drilled tables for easy set-ups or tables can be quickly removed for installation of special fixtures or jigs. Write for Bulletin WP 22, **CULLEN-FRIESTEDT CO., 1305 S. Kilbourn Avenue, Chicago 23, Illinois.**

CULLEN-FRIESTEDT · CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

Continental Tool Works Div.
Detroit Tap & Tool Co.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Gammons-Hoaglund Co.
Genesee Mfg. Co., Inc.
Gorton, George, Mch. Co.
Haynes Stellite Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kennametal, Inc.
McCrosky Tool Corp.
Modern Tool Wks.
Morse Twist Drill & Mach. Co.
National Twist Drill & Tool Co.
O.K. Tool Co., Inc.
Pratt & Whitney Co.
Producto Machine Co.
Reed-Prentice Corp.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING-OFF MACHINES

Avey Drilling Machine Co.
Bardons & Oliver, Inc.
Bridgeport Safety Emery Wheel Co., Inc.
Brown & Sharpe Mfg. Co.
Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
Landis Machine Co.

Abrasive Wheel

Armstrong Brothers Tool Co.
Bridgeport Safety Emery Wheel Co., Inc.
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.
Delta Mfg. Div. Rockwell Mfg. Co.

Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF TOOLS

Armstrong Brothers Tool Co.
Empire Tool Co.
Firth-Sterling Steel & Carbide Corp.
Haynes Stellite Co.
Luers, J. Milton
Pratt & Whitney Co.
Williams, J. H., & Co.

CUTTING-OFF WHEELS, Abrasive

Bay State Abrasive Co.
Carborundum Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

CYLINDER BORING MACHINES

Baker Brothers, Inc.
Barnes Drill Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ex-Cell-O Corp.
Ingersoll Milling Mch. Co.
Moline Tool Co.

CYLINDERS, Hydraulic

American Hollow Boring Co.
Anker-Holth Mfg. Co.
Barnes, John S., Corp.
Clearing Mch. Corp.
Denison-Engineering Co.
Galland-Henning Mfg. Co.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydraulic Products Co.
Logansport Machine Co., Inc.
Oilgear Co.
Rockford Machine Tool Co.
Skinner Chuck Co.

Pneumatic

Anker-Holth Mfg. Co.
Bellows Senacon Co.
Clearing Mch. Corp.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Products Co.
Skinner Chuck Co.

DEALERS, Machinery

Besly, Chas. H., & Co.
Botwinik Brothers of Mass., Inc.
Earle Gear & Mch. Co.
Lunden & Bonthron
Motch & Merryweather Mchry. Co.
Ryerson, Joseph T., & Son, Inc.
Simmons Machine Tool Corp.

DEMAGNETIZERS

Blanchard Mch. Co.
Heald Machine Co.
Walker, O. S., Co., Inc.

DESIGNERS, Machine and Tool

Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Ruthman Mchry. Co.
Snyder Tool & Engrg. Co.
Vinco Corporation

DIAMONDS and Diamond Tools

Bausch & Lomb Optical Co.
Desmond-Stephan Mfg. Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Smit, J. K., & Co.

DIE CASTING MACHINES

Hydraulic Press Mfg. Co.
Kux Machine Co.
Lester-Phoenix, Inc.
Madison-Kipp Corp.
Reed-Prentice Corp.

DIE CASTING

See Castings, Die.

DIE CUSHIONS, Pneumatic

Bliss, E. W., Co.
Clearing Mch. Corp.
Verson Allsteel Press Co.

AN *Invitation* TO GEAR BUYERS

Many of the country's top-ranking manufacturers look upon our gear engineering facilities as part of their own plant! And rightly so! For over 25 years our job has been the production of precision gears to customers' specifications. Once your specifications are in our files, reorders are filled automatically. As specialists in this field, we have the equipment and experience to do our job well. Let us quote on YOUR requirements now!

PERKINS Precision, Custom-Cut GEARS

PERKINS MAKES: Helical Gears, Bevel Gears, Ratchets, Worm Gears, Spiral Gears, Spur Gears, Ground Thread Worms

PERKINS MACHINE & GEAR COMPANY • Springfield 2, Mass.

DIE INSERTS, Carbide
Carboloy Co., Inc.
Firth-Sterling Steel & Carbide Corp.
Kennametal, Inc.

DIE MAKERS' SUPPLIES
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Company, Inc.

DIE MAKING MACHINES
Grob Brothers
Kearney & Trecker Corp.
Oliver Instrument Co.

DIE SETS, Standard
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
Pratt & Whitney Co.
Producto Machine Co.

DIE SINKING MACHINES
Cincinnati Milling Mch. Co.
Gorton, George, Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.

DIE SINKING PRESSES
Baldwin Locomotive Works
Kearney & Trecker Corp.

DIE STOCKS
See Stocks, Die.

DIES, Lettering and Embossing
Noble & Westbrook Mfg. Co.
Sossner, Inc.

DIES

Sheet Metal, Etc.
Baumbach, E. A., Mfg. Co.
Bliss, E. W., Co.
Columbus Die, Tool & Mch. Co.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Ruthman Mchry. Co.
Taft-Peirce Mfg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Waltham Mch. Wks.

Threading
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Eastern Mch. Screw Corp.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Acme Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

Threading Opening
Eastern Mch. Screw Corp.
Errington Mechanical Laboratory
Geometric Tool Co.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
National Acme Co.
Oster Manufacturing Co.

Thread Rolling
Hanson-Whitney Mch. Co.
Pratt & Whitney Co.
Reed Rolled Thread Die Co.

DISCS, Abrasive
Besly, Chas. H., & Co.
Carborundum Co.
Gardner Mch. Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Walls Sales Corp.

DIVIDING HEADS
See Index Centers.

DOWEL PINS
Allen Mfg. Co.
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Co., Inc.

DRAFTING MACHINES
Universal Drafting Machine Co.

DRAWING BOARDS AND TABLES
Universal Drafting Machine Co.

DRESSERS, Grinding Wheel
Carboloy Co., Inc.
Desmond-Stephan Mfg. Co.
Hanchett Mfg. Co.
Lee, K. O., & Son Co.
Norton Co.
Smit, J. K., & Co.
Standard Tool Co.
Vinco Corporation

DRIFTS, DRILL
Armstrong Bros. Tool Co.
Standard Tool Co.

DRILL HEADS

Unit Type
Barnes Drill Co.
Rehnberg-Jacobson Mfg. Co.

Multiple
Baker Brothers, Inc.
Barnes Drill Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Delta Mfg. Div., Rockwell Mfg. Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Ex-Cell-O Corp.
Langelier Mfg. Co.
Moline Tool Co.
National Automatic Tool Co.
Thriftmaster Products, Div., Thomson Industries, Inc.

DRILL SOCKETS
Armstrong Bros. Tool Co.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

DRILL SPEEDERS
Graham Mfg. Co., Inc.

DRILL STANDS
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DRILLING MACHINES

Automatic
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Bodine Corp.
Bradford Machine Tool Co.
Buhr Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.

Bench
Ames, B. C., Co.
Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Dumore Co.
Elgin Tool Wks., Inc.
Fosdick Machine Tool Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
Production Machine Co.
Walker-Turner Co., Inc.

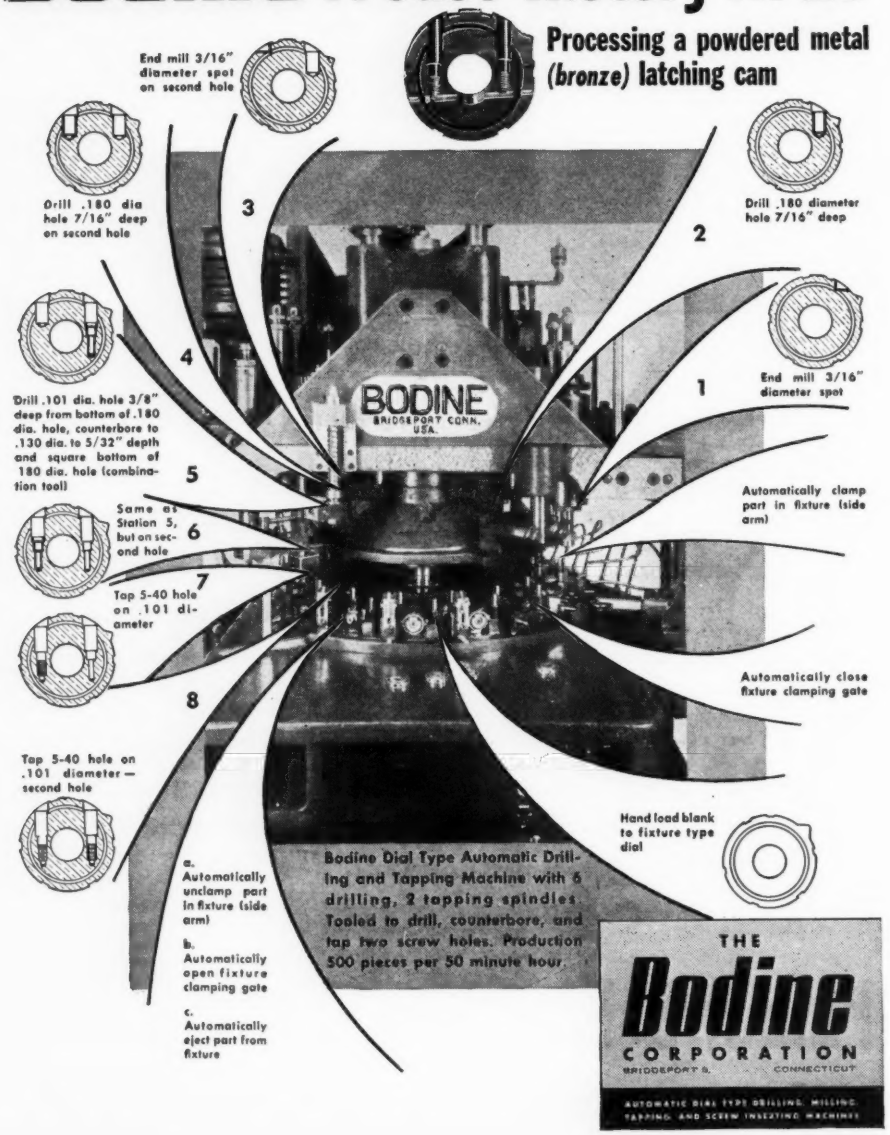
Boiler
Cincinnati Bickford Tool Co.
Foote-Burt Co.

Gang
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Bryant Machinery & Engineering Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Machine Co.
Producto Machine Co.

Horizontal Duplex
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Frew Machine Co.
Kingsbury Mch. Tool Corp.

Bodine..Case History No. 20

Processing a powdered metal (*bronze*) latching cam


End mill 3/16" diameter spot on second hole
Drill .180 dia hole 7/16" deep on second hole
Drill .180 diameter hole 7/16" deep
Drill .101 dia. hole 3/8" deep from bottom of .180 dia. hole, counterbore to .130 dia. to 5/32" depth and square bottom of 180 dia. hole (combination tool)
End mill 3/16" diameter spot
Same as Station 5, but on second hole
Automatically clamp part in fixture (side arm)
Tap 5-40 hole on .101 diameter
Automatically close fixture clamping gate
Tap 5-40 hole on .101 diameter — second hole
Hand load blank to fixture type dial
a. Automatically unclamp part in fixture (side arm)
b. Automatically open fixture clamping gate
c. Automatically eject part from fixture
BODINE
BRIDGEPORT CONN. USA
1
2
3
4
5
6
7
8

Bodine Dial Type Automatic Drilling and Tapping Machine with 6 drilling, 2 tapping spindles. Tooled to drill, counterbore, and tap two screw holes. Production 500 pieces per 50 minute hour.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING AND SCREW INSERTING MACHINES

Langelier Mfg. Co.
National Automatic Tool Co.
Sellers, Wm., & Co., Inc.
Sundstrand Mch. Tool Co.

Inverted

Baker Brothers, Inc.
Barnes Drill Co.

Multiple Center Column Type

Barnes Drill Co.

Multiple Spindle

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bradford Machine Tool Co.
Bryant Machinery & Engineering Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Cross Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Greenlee Bros. & Co.
Henry & Wright Mfg. Co.
Ingersoll Milling Mch. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Taylor & Fenn Co.

Radial

American Tool Wks. Co.
Canedy-Otto Mfg. Co.
Carlton Machine Tool Co.
Cincinnati Bickford Tool Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Giddings & Lewis Mch. Tool Co.

Rail

See Drilling Machines, Gang.

Sensitive

Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Producto Machine Co.
Ryerson, Joseph T., & Son, Inc.
Taylor & Fenn Co.

Upright

Atlas Press Co.
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Bryant Machinery & Engineering Co.
Buffalo Forge Co.
Canedy-Otto Mfg. Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Delta Mfg. Div. Rockwell Mfg. Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Mch. Co.
Producto Machine Co.
Rehnberg-Jacobson Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

Wall Radial

Canedy-Otto Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.

DRILLS

Center

Cleveland Twist Drill Co.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Warner & Swasey Co.

Core

Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel & Carbide Corp.
Gairing Tool Co.
Haynes Stellite Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

Portable Electric

Duncore Co.
Ryerson, Joseph T., & Son, Inc.

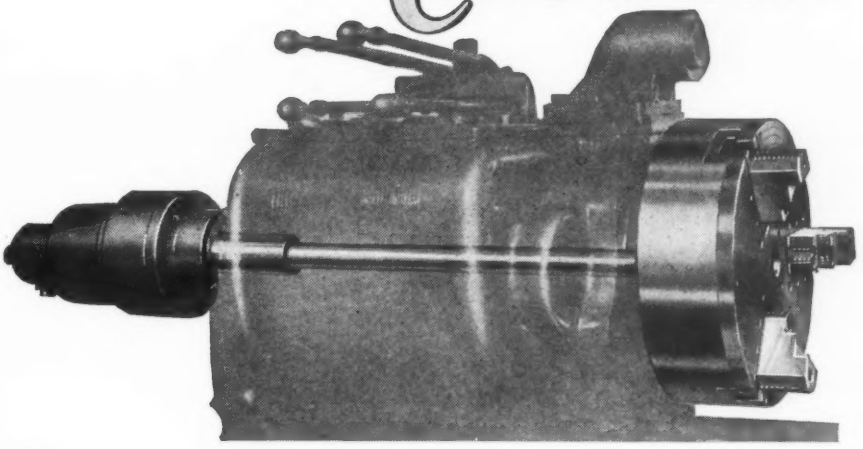
Portable Pneumatic

Ingersoll-Rand Co.
Rotor Tool Co.

Ratchet

Armstrong Bros. Tool Co.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

save time, save manpower with UNION POWER OPERATED CHUCKS



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UNION Electrically Operated Chucks have been giving effortless and trouble-free service for over 12 years. Pieces are securely held with power cut off. Power requirements are negligible. Fully adjustable jaw pressure available in any jaw position.

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Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

Wire
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DUPLICATORS
Rockford Machine Tool Co.

DUST CONTROL SYSTEMS
Breuer Electric Mfg. Co.
Schneible, Claude B., Co.

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Feedrail Corp.
General Electric Co.
Richardson-Allen Corp.

ELEVATORS
Otis Electric Co.

EMERY WHEELS
See Grinding Wheels.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

ENGRAVING MACHINES
Gorton, George, Mch. Co.

EXTRACTORS, Screw
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.

FACING MACHINE
Ex-Cell-O-Corp.

FANS, Exhaust, Electric Ventilating
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General Electric Co.

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U. S. Tool Co., Inc.
V & O Press Co.

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Lincoln Park Industries, Inc.
Pratt & Whitney Co.
Strand, N. A., & Co.

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Cochrane-Bly Co.
DoAll Co.
Grob Brothers
Oliver Instrument Co.

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United States Electrical Tool Co.

FILTERS, COOLANT AND OIL
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Frantz, S. G., Co., Inc.

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Watson-Stillman Co.

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See Couplings, Flexible.

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Pratt & Whitney Co.
Strand, N. A., & Co.
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Baldwin Locomotive Works
Hill Acme Co.
National Machinery Co.

FORGINGS

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Kropp Forge Co.
Williams, J. H., & Co.

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American Hollow Boring Co.
Bethlehem Steel Co.

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Jones & Laughlin Steel Corp.
Kropp Forge Co.
Morgan Engineering Co.

Manganese, Bronze, Etc.
Cramp Brass & Iron Foundries Div.

Upset
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Kropp Forge Co.
Williams, J. H., & Co.

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Chambersburg Engineering Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
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Hydraulic Press Mfg. Co.
O'Neil-Irwin Mfg. Co.
Yoder Co.

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U. S. Tool Co., Inc.

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Pratt & Whitney Co.

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Mahon, R. C., Co.

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General Electric Co.
Hayes, C. I., Inc.
Leeds & Northrup Co.

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Lee, K. O., & Son Co.
Standard Pressed Steel Co.

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Pratt & Whitney Co.
Scherr, George, Co., Inc.
Van Keuren Co.

GAGES, Comparator
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Federal Products Corp.
Jones & Lamson Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Sheffield Corp.
Woodworth, N. A., Co.

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Federal Products Corp.
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Standard Gage Co., Inc.
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Bristol Co.
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Federal Products Corp.
Scherr, George, Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
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Electric
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Scherr, George, Co., Inc.
Standard Gage Co.
Starrett, L. S., Co.

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Brown & Sharpe Mfg. Co.
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Federal Products Corp.
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Haynes Stellite Co.
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When does a speed reducer need the reserve strength BACKBONE provides?

Sudden shock loads, sustained heavy loads, long periods of continuous running, and other adverse operating conditions, all demand something extra in load-carrying ability from a speed reducer.

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Farrel speed reducers are available in a wide range of ratios and capacities. Designs include single, double and multiple reduction units, as well as speed change units having two or more selective speeds, right angle drives and drives to meet special requirements. Write for descriptive catalog No. 438.

FB-363

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Vinco Corporation

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Greenfield Tap & Die Corp.
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Pratt & Whitney Co.
Sheffield Corp.
Size Control Co.
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GEAR MOTORS

See Speed Reducers.

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Boston Gear Works, Inc.
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Cincinnati Gear Co.
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Foote Bros. Gear & Machine Corp.
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Gear Specialties
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Grant Gear Wks., Inc.
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Massachusetts Gear & Tool Co.
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New Jersey Gear & Mfg. Co.
Ohio Gear Co.
Perkins Mch. & Gear Co.
Philadelphia Gear Works
Pittsburgh Gear & Machine Co.
Sier-Bath Gear & Pump Co., Inc.
Stahl Gear & Machine Co.
Taylor Mch. Co.
Technical Products Co.

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Philadelphia Gear Works

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Diefendorf Gear Corp.
Earle Gear & Mch. Co.
Foote Bros. Gear & Machine Corp.
Ganschow Gear Co.
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Grant Gear Works, Inc.
Hartford Special Mchy. Co.
James, D. O., Mfg. Co.
Massachusetts Gear & Tool Co.
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Philadelphia Gear Works
Pittsburgh Gear & Mch. Co.
Stahl Gear & Machine Co.
Taylor Mch. Co.

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Lincoln Electric Co.
Master Electric Co.
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Sun Oil Co.
Texas Co.
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Sundstrand Mch. Tool Co.

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Pratt & Whitney Co.

Oilstone, for Woodworking Tools

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Pneumatic

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Madison-Kipp Corp.
Rotor Tool Co.

Portable Electric and Toolpost

Dumore Co.
Haskins, R. G., Co.

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Hill Acme Co.
Mattison Mach. Wks.
Porter-Cable Machine Co.
Production Machine Co.
Walker-Turner Co., Inc.
Walls Sales Corp.

Bench

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Delta Mfg. Div. Rockwell Mfg. Co.
Hardinge Brothers, Inc.
Rivett Lathe & Grinder, Inc.
Ryerson, Joseph T., & Son, Inc.
Walker-Turner Co., Inc.

Camshaft

Landis Tool Co.
Norton Co.

Carbide Tool

Carboloy Co., Inc.
Ex-Cell-O Corp.
Oliver Instrument Co.

Centerless

Cincinnati Grinders, Inc.
Heald Machine Co.
Landis Tool Co.
Triplex Machine Tool Corp.

Chaser or Die

Eastern Mch. Screw Corp.
Fitchburg Grinding Mch. Corp.
Geometric Tool Co.
Landis Machine Co., Inc.

Chucking

Bryant Chucking Grinder Co.
Fitchburg Grinding Mch. Corp.

Crankshaft

Landis Tool Co.
Norton Co.

Cylinder

Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.

Cylindrical

Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Cincinnati Grinders, Inc.
Fitchburg Grinding Mch. Corp.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Morse Twist Drill & Mch. Co.
Norton Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Thompson Grinder Co.
Triplex Machine Tool Corp.

Disc

Besly, Chas. H., & Co.
Gardner Machine Co.
Hanchett Mfg. Co.
Porter-Cable Machine Co.
Production Mch. Co.

Drill

Delta Mfg. Div. Rockwell Mfg. Co.
Gallmeyer & Livingston Co.
Oliver Instrument Co.
Union Twist Drill Co.

Face

Abrasive Mch. Tool Co.
Hanchett Mfg. Co.
Oliver Instrument Co

Flexible Shaft

See Flexible Shaft Equipment.

Gear Tooth

Pratt & Whitney Co.

For Sharpening Turning and Planing Tools

Delta Mfg. Div. Rockwell Mfg. Co.
Oliver Instrument Co.
Production Mch. Co.
Walker, O. S., Co., Inc.
Waltham Mch. Wks.

Internal

Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Rivett Lathe & Grinder, Inc.
Wicaco Machine Corp.

Jig

Moore Special Tool Co., Inc.

Knife and Shear Blade

Bridgeport Safety Emery Wheel Co., Inc.
Hill Acme Co.

Piston Ring

Arter Grinding Machine Co.
Bridgeport Safety Emery Wheel Co., Inc.
Heald Machine Co.

Profile

Boyar-Shultz Corp.

Pulleys

Abrasive Mch. Tool Co.

Radial, Ball Race, Etc.

Landis Tool Co.

Radius, Link

Consolidated Mch. Tool Corp.
Sundstrand Mch. Tool Co.

Ring Wheel

Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Roll

Farrel-Birmingham Co., Inc.
Landis Tool Co.
Norton Co.

Spline

Fitchburg Grinding Machine Corp.
Vinco Corporation

Surface

Abrasive Mch. Tool Co.
Arter Grinding Machine Co.
Blanchard Mch. Co.
Brown & Sharpe Mfg. Co.
DoAll Co.
Foote-Burt Co.
Gallmeyer & Livingston Co.
Gardner Mch. Co.
Hanchett Mfg. Co.
Heald Machine Co.
Hill Acme Co.
Leach, H., Machinery Co.
Mattison Machine Works
Norton Co.
Pratt & Whitney Co.
Producto Machine Co.
Reid Bros. Co., Inc.
Robot Machinery Co.
Thompson Grinder Co.
Walker, O. S., Co., Inc.

Tap

Ex-Cell-O Corp.
Jones & Lamson Mch. Co.

Thread

Ex-Cell-O Corp.
Jones & Lamson Mch. Co.
Landis Machine Co., Inc.

Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Mch. Co.
DoAll Co.
Fellows Gear Shaper Co.
(Helical Gear Shaper Cutters)
Fitchburg Grinding Mch. Corp.
Gallmeyer & Livingston Co.
Ingersoll Milling Mch. Co.
Landis Tool Co.
LeBlond, R. K., Mch. Tool Co.
Lee, K. O., & Son Co.
Norton Co.
Oliver Instrument Co.
Pratt & Whitney Co.
Thompson Grinder Co.
Union Twist Drill Co.

Worm

Jones & Lamson Mch. Co.
Pratt & Whitney Co.

GRINDING WHEELS

Bakelite Corp.
Bay State Abrasive Co.
Besly, Chas. H., & Co.
Blanchard Mch. Co.
Bridgeport Safety Emery Wheel Co., Inc.
Carborundum Co.
Electro Refractories & Alloy Corp.
Norton Co.
Raybestos-Manhattan, Inc.,
Manhattan-Rubber Div.
Simonds Abrasive Co.
Vitrified Wheel Co.

GROOVING TOOL, INTERNAL

Waldes Kohinoor, Inc.

HAMMERS, Drop

Bliss, E. W., Co.
Chambersburg Engineering Co.
Erie Foundry Co.
Morgan Engineering Co.

Forging Air

Lobdell Co.

Pneumatic

Chambersburg Engineering Co.
Madison-Kipp Corp.

Power

Lobdell Co.
McKiernan-Terry Corp.
Quickwork-Whiting Div. of Whiting Corp.

Soft

Chambersburg Engineering Co.
S. & H. Soft Hammer Products Co.

Steam

Chambersburg Engineering Co.
Erie Foundry Co.

HANGERS, Shaft

Boston Gear Works, Inc.
Foote Bros. Gear & Machine Corp.
Hill Acme Co.
Hyatt Bearings Div.,
General Motors Sales Corp.
S K F Industries, Inc.
Standard Pressed Steel Co.

HARDENING EQUIPMENT, INDUCTION

Lepel High Frequency Laboratories, Inc.
Ohio Crankshaft Co.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co.
Wilson Mechanical Instrument Co., Inc.

HEADING MACHINES

National Machinery Co.

HEAT TREATMENT OF STEEL

Bennett Metal Treating Co.
Ohio Gear Co.
Pittsburgh Gear Mch. Co.

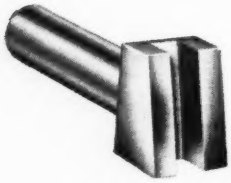
HOBBING MACHINES

See Gear Cutting Machines, Helical and Spur (Hob), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co.
Brown & Sharpe Mfg. Co..
Michigan Tool Co.
National Twist Drill & Tool Co.
New Jersey Gear & Mfg. Co.
Union Twist Drill Co.

miracles and "Soluble" Cutting Compounds

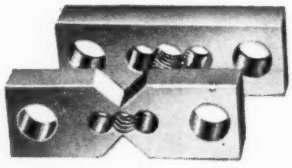


Solvol and KleenKut, Stuart's water-mixed cutting fluids, while they share in many a machining "miracle," are not "miracle" compounds. They *are* expertly engineered and manufactured products, whose performance is unsurpassed among water-mix, or "soluble" cutting fluids.

Stuart's Solvol, a "super soluble" because of its unusually high cutting quality, will handle jobs beyond the scope of conventional water-mix products, including many so-called all-purpose compounds.

Stuart's KleenKut, a more conventional product, is still an outstanding "soluble" cutting compound with a long record of superior performance.

Try Solvol or KleenKut water-mixed cutting fluids the next time you want a machining "miracle."



Have you received your copy of "Water-Mixed Cutting Fluids"?

D.A. Stuart Oil Co. LIMITED
EST. 1865

2739 SOUTH TROY STREET, CHICAGO 23, ILL.

Stuart Oil Engineering Goes With Every Barrel

HOIST HOOKS
Bethlehem Steel Co.
Williams, J. H., & Co.

HOISTING AND CONVEYING MACHINERY
Master Electric Co.
Shepard Niles Crane & Hoist Corp.

HOISTS, Air
Hanna Engineering Works
Ingersoll-Rand Co.

Chain, Etc.
Ryerson, Joseph T., & Son, Inc.
Union Mfg. Co.

Electric
Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.
Union Mfg. Co.

HONES
Carborundum Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co.
Barnes, W. F. and John, Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, External
Barnes Drill Co.
Micromatic Hone Corp.

Hose, Leather, Rubber, Metallic, Etc.
American Metal Hose Div., American Brass Co.
Raybestos-Manhattan, Inc. Manhattan-Rubber Div.

HYDRAULIC MACHINERY, Tools and Equipment
Baldwin Locomotive Works
Barnes, John S., Corp.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Cross Co.
Denison Engineering Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Oilgear Co.
Rockford Machine Tool Co.
Sundstrand Mch. Tool Co.
Watson-Stillman Co.

HYDRAULIC POWER UNITS OR TOOL HEADS
Anker-Holth Mfg. Co.
Barnes Drill Co.
Barnes, John S., Corp.
Barnes, W. F. and John, Co.
Ex-Cell-O Corp.
Hannifin Mfg. Co.
National Automatic Tool Co.

HYDRAULIC, Tool Head or Power Unit
Barnes Drill Co.
National Automatic Tool Co.
New Britain-Gridley Mch. Div. New Britain Machine Co.

INDEX CENTERS
Abrasive Mch. Tool Co.
Brown & Sharpe Mfg. Co.
Cochrane-Bly Co.
Kempsmith Mch. Co.
Vinco Corporation

INDEXING and Spacing Fixtures
Hartford Special Mchry. Co.
Vinco Corporation

INDICATOR, Dial
Ames, B. C., Co.
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Speed
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

Test
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

INDUCTION HEATING EQUIPMENT
Lepel High Frequency Laboratories, Inc.
Ohio Crankshaft Co.

INGOTS, Manganese, Bronze and Brass
Cramp Brass & Iron Foundries Div.

INTENSIFIERS, Hydraulic
Baldwin Locomotive Works
Elmes Engineering Works
Farquhar, A. B., Co.
Hydraulic Press Mfg. Co.
Morgan Engineering Co.
Watson-Stillman Co.

JACKS, Planer
Armstrong Bros. Tool Co.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
American Type Foundries, Inc.
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Ingersoll Milling Mch. Co.
Logansport Machine Co., Inc.
Merz Engineering Co.
Sundstrand Mch. Tool Co.
Vinco Corporation

KEYSEATERS
Baker Bros., Inc.
Consolidated Mch. Tool Corp.
Davis Keyseater Co.
Lapointe Machine Tool Co.

KNURL HOLDERS
Brown & Sharpe Mfg. Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.

KNURLING TOOLS
Armstrong Bros. Tool Co.
Fakes, Joseph B., & Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.
Williams, J. H., & Co.

LAPPING MACHINES
Cincinnati Grinders, Inc.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Norton Co.
Sommer & Adams Co.
Spitfire Tools, Inc.

LATHE ATTACHMENTS
American Tool Wks. Co.
Atlas Press Co.
Bradford Machine Tool Co.
Gisholt Mch. Co.
Hendey Machine Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
McCrosky Tool Corp.
Monarch Mch. Tool Co.
Newton Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

LATHES

Automatic
Baird Machine Co.
Cross Co.
Gisholt Mch. Co.
Goss & DeLeeuw Mch. Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Monarch Mch. Tool Co.
National Acme Co.
New Britain Gridley Mch. Div., New Britain Machine Co.
Porter-Cable Machine Co.
Potter & Johnston Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.
Wickes Bros.

Axles and Shaft
Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Bench
Ames, B. C., Co.
Ames Precision Mch. Wks.
Atlas Press Co.
Elgin Tool Wks., Inc.
Hardinge Brothers, Inc.
LeBlond, R. K., Mch. Tool Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
South Bend Lathe Wks.
Stark Tool Co.

Boring
Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Wickes Bros.

Brass Workers'
Acme Machine Tool Co.
Bardons & Oliver, Inc.
Gisholt Mch. Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.
Warner & Swasey Co.

Crankshaft
Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.
Wickes Bros.

Double-End
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.

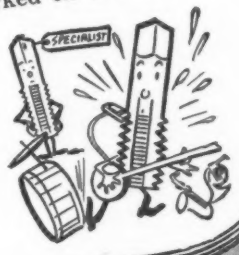
TAPPING TIPS*

From Woody Spencer's Notebook

NO TAP CAN BE A ONE-MAN BAND!

A lot of tapping troubles bob up when fellows forget that taps are made for special purposes. You can't expect one tap to do everything. For instance, a tap that's ground with a rake for steel falls down flat when it's tried in brass or cast iron. Plastics, too, have brought a lot of new tapping requirements.

Best way is to make sure first that the tap is ground for the material at hand. Ordinarily, taps designed for steel are not marked. But we try to make it easy for our customers. When requested, taps for other materials are marked on the shank. And we don't charge anything extra either. On your next order, have us mark your taps with material designations. Bet you'll find it helps out a lot with your tapping.



These Tapping Tips of Woody Spencer's aren't intended as technical aids in solving tapping problems. They're just hints and short cuts Woody has gathered in his rounds among the shops and wants to pass on for whatever they're worth in making tapping jobs run a little quicker and easier.

Put the technical questions up to the engineers. If you're having some trouble, send us the complete details of the job—material, diameter, depth, lubricant, through or blind hole, etc. Our engineers will be glad to offer specific recommendations. No obligations, of course.

*NOTE: Woody Spencer's Tapping Tips will appear here as regularly as "Woody" gets time to write them up. Look for them. Our complete, new catalog just off the press. Send your request on Company stationery.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company
Cleveland 3, Ohio

Sundstrand Mch. Tool Co.
Wickes Bros.

Engine and Toolroom

Acme Machine Tool Co.
American Tool Wks. Co.
Atlas Press Co.
Axelson Manufacturing Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Hendey Machine Co.
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.
Lodge & Shipley Mch. Tool Co.
Logan Engineering Co.
Mackintosh & Hemphill Co.
Monarch Mch. Tool Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
South Bend Lathe Wks.
Springfield Mch. Tool Co.
Wickes Bros.

Extension Bed and Gap

Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
South Bend Lathe Wks.
Warner & Swasey Co.

Gun

Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.
Wickes Bros.

Manufacturing Type

Lipe-Rollway Corporation
Lodge & Shipley Mch. Tool Co.

Spinning

See Chucking Machines.

Toolroom

See Lathes, Engine and Toolroom.

Turret

Acme Machine Tool Co.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Bullard Company
Foster Div., International Detrola Corp.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
(Bench or Cabinet Mounting)
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
National Acme Co.
Oster Mfg. Co.
Potter & Johnston Mch. Co.
Production Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Stearns-Roger Mfg. Co.
Warner & Swasey Co.

Turret Automatic

Potter & Johnston Mch. Co.

Vertical Turret

Bullard Company

LEVELS

Pratt & Whitney Co.
Starrett, L. S., Co.
Universal Boring Mch. Co.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

LUBRICATING SYSTEMS

Madison-Kipp Corp.
Manzel Brothers Co.
Rivett Lathe & Grinder, Inc.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co.
Noble & Westbrook Mfg. Co.
Sossner, Inc.

MEASURING MACHINES AND INSTRUMENTS, PRECISION

Federal Products Corp.
Hanson-Whitney Mch. Co.
Norma-Hoffmann Bearings Corp.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Van Keuren Co.
Vinco Corporation

MEASURING WIRES, Thread, Spline and Gear

Van Keuren Co.

METAL DISINTEGRATOR

Elox Corp.

METALS, Bearing

See Bearings, Bronze, Babbitt, Etc. and Bushings, Brass, Bronze, Etc.

METALS, Perforated

Chicago Perforating Co.

METERS

See Recording Instruments.

MICROMETERS

Bath, John, & Co., Inc.
Brown & Sharpe Mfg. Co.
Davis & Thompson Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.
Van Keuren Co.

MICROSCOPES, Toolmakers

Bausch & Lomb Optical Co.
Scherr, George, Co., Inc.

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Elgin Tool Wks., Inc.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Porter Cable Machine Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Sundstrand Mch. Tool Co.
Van Norman Co.

MILLING MACHINES

Automatic

Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Jones & Lamson Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.
U. S. Tool Company, Inc.

Bench

Ames, B. C., Co.
Atlas Press Co.
Burke Machine Tool Co.
Hardinge Brothers, Inc.
(Bench or Pedestal Type)
Pratt & Whitney Tool Co.
Stark Tool Co.

Circular Continuous

Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.

Die Sinking

See Die Sinking Machines.

Duplex

Cincinnati Milling Machine Co.
Consolidated Mch Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Taylor & Fenn Co.

Hand

Burke Machine Tool Co.
Frew Machine Co.
Nichols, W. H., & Sons
Sundstrand Mch. Tool Co.
Van Norman Co.

Horizontal, Plain and Universal

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Cochrane-Bly Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Frew Machine Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Machinery Mfg. Co.
Ohio Machine Tool Co.
Producto Machine Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
Sundstrand Mch. Tool Co.
Van Norman Mch. Tool Co.

Lincoln Type

Brown & Sharpe Mfg. Co.
Sundstrand Mch. Tool Co.

Planer Type

Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Stokerunit Corp.

Planetary

Cross Gear & Machinery Co.

Ram Type, Universal

Van Norman Co.

Vertical

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Machinery Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Sidney Machine Tool Co.
Sommer & Adams Co.
Sundstrand Mch. Tool Co.
Taylor & Fenn Co.

MODEL AND EXPERIMENTAL WORK

See Special Machinery Tools.

MOLD AND DIE COPYING MACHINES

Gorton, George, Mch. Co.

MOLDING MACHINES, Plastic Products

Hydraulic Press Mfg. Co.
Reed-Prentice Corp.
Watson-Stillman Co.

MOLYBDENUM

Climax Molybdenum

MOTORS, Electric

Dumore Co.
General Electric Co.
Lincoln Electric Co.
Master Electric Co.
Reliance Electric & Engrg. Co.
Star Electric Motor Co.

MOUNTINGS, RUBBER, JOINTS AND COUPLINGS

Lord Manufacturing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

MULTIPLE-SLIDE FORMING MACHINES

Baird Machine Co.
U. S. Tool Co., Inc.

NAME PLATES

Noble & Westbrook Mfg. Co.

NIBBLING MACHINES

Campbell, Andrew C., Div., American Chain & Cable Co., Inc.
Gray Machine Co.
National Machine Tool Co.

Nickel

International Nickel Co.

NIPPLE THREADING MACHINERY

Landis Mch. Co., Inc.
Oster Manufacturing Co.

NUMBERING MACHINES

Noble & Westbrook Mfg. Co.

NUT MAKING MACHINERY

National Machinery Co.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Parker-Kalon Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

NUTS, Self-Locking

Elastic Stop Nut Corp. of America

NUTS, Thumb or Wing and Cap

Republic Steel Co.
(Union Drawn Steel Div.)
Williams, J. H., & Co.

OIL CAPS

Besly, Chas. H., & Co.
Gits Bros. Mfg. Co.
Trico Fuse Mfg. Co.

OIL EXTRACTORS

DeLaval Separator Co.

OIL GROOVERS

Hanson-Whitney Mch. Co.
Wicaco Machine Corp.

OIL HOLE COVERS

Gits Bros. Mfg. Co.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co.
Madison-Kipp Corp.
Manzel Brothers Co.
Trico Fuse Mfg. Co.

OILS, Cutting

Cimcool Div., Cincinnati Milling Machine Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Lubricating

Besly, Chas. H., & Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Quenching and Tempering

Gulf Oil Corp.
Shell Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.

Soluble

See Compounds, Cutting, Grinding, Metal Drawings, Etc.

ORDNANCE MACHINES, Special

Rehnberg-Jacobson Mfg. Co.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Garlock Packing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.
Watson-Stillman Co.

PARALLELS

Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

PATTERNS, WOOD

Mummert-Dixon Co.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS

Norma-Hoffmann Bearings Corp.
S K F Industries, Inc.
Standard Pressed Steel Co.

PIPE, BRASS AND COPPER

American Brass Co.

PIPE CUTTING AND THREADING MACHINES

Foote-Burt Co.
Landis Mch. Co., Inc.
Oster Manufacturing Co.

PIPE, STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp. Div.)
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

PIPE TONGS

Williams, J. H., & Co.

PLANER ATTACHMENTS

Cincinnati Planer Co.
Consolidated Mch. Tool Co.
Hanson-Whitney Mch. Co.
Rockford Machine Tool Co.

PLANERS

Baldwin Locomotive Works
Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
(Incl. Plate, Rotary and Crank Types)
Ohio Machine Tool Co.
Rockford Machine Tool Co.

Openside

Cincinnati Planer Co.
Rockford Machine Tool Co.

PLASTICS and Plastic Products

Bakelite Corp.

PLATE ROLLS

Baldwin Locomotive Works
Bethlehem Steel Co.
Cleveland Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

PLATES, Surface

Brown & Sharpe Mfg. Co.
Jones Machine Tool Wks., Inc.
Rotor Tool Co.
Scherr, George, Co., Inc.
Taft-Peirce Mfg. Co.
U. S. Tool Company, Inc.
Vinco Corporation

PNEUMATIC EQUIPMENT

Anker-Holt Mfg. Co.
Bellows Senacon Co.
Bliss, E. W., Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.

POLISHING LATHES and Machines

Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
DoAll Co.
Gardner Machine Co.
Production Mch. Co.
Sundstrand Mch. Tool Co.

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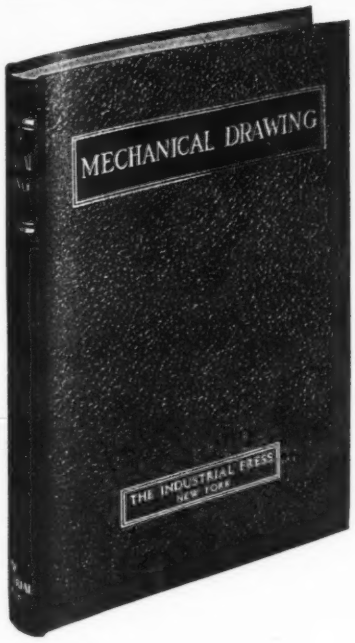

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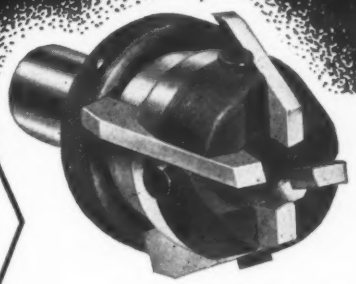

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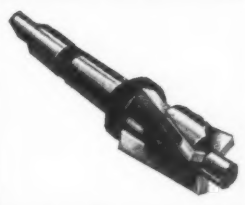

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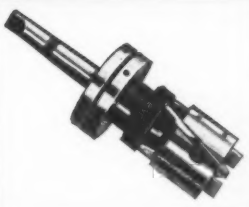

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Jones & Laughlin Steel Corp.
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(Union Drawn Steel Div.)
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Simonds Saw & Steel Co.
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Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.
Wyckoff Steel Co.

Cold Drawn
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Crucible Steel Co. of America
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Jones & Laughlin Steel Corp.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Wheelock, Lovejoy & Co., Inc.
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Composite Tool and Die
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High Speed Tool
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Armstrong Bros. Tool Co.
Bethlehem Steel Co.
Carpenter Steel Co.
Cleveland Twist Drill Co.
Crucible Steel Co. of America
Firth-Sterling Steel & Carbide Corp.
Republic Steel Corp.
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Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

Machine
Bethlehem Steel Co.
Crucible Steel Co. of America
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Vanadium Alloys Steel Co.
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Standard Tool Co.

Torque Measuring
Elastic Stop Nut Corp. of America
Sturtevant, P. A., Co.
Williams, J. H., & Co.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
The V & O Press Company, Incorporated
HUDSON, NEW YORK

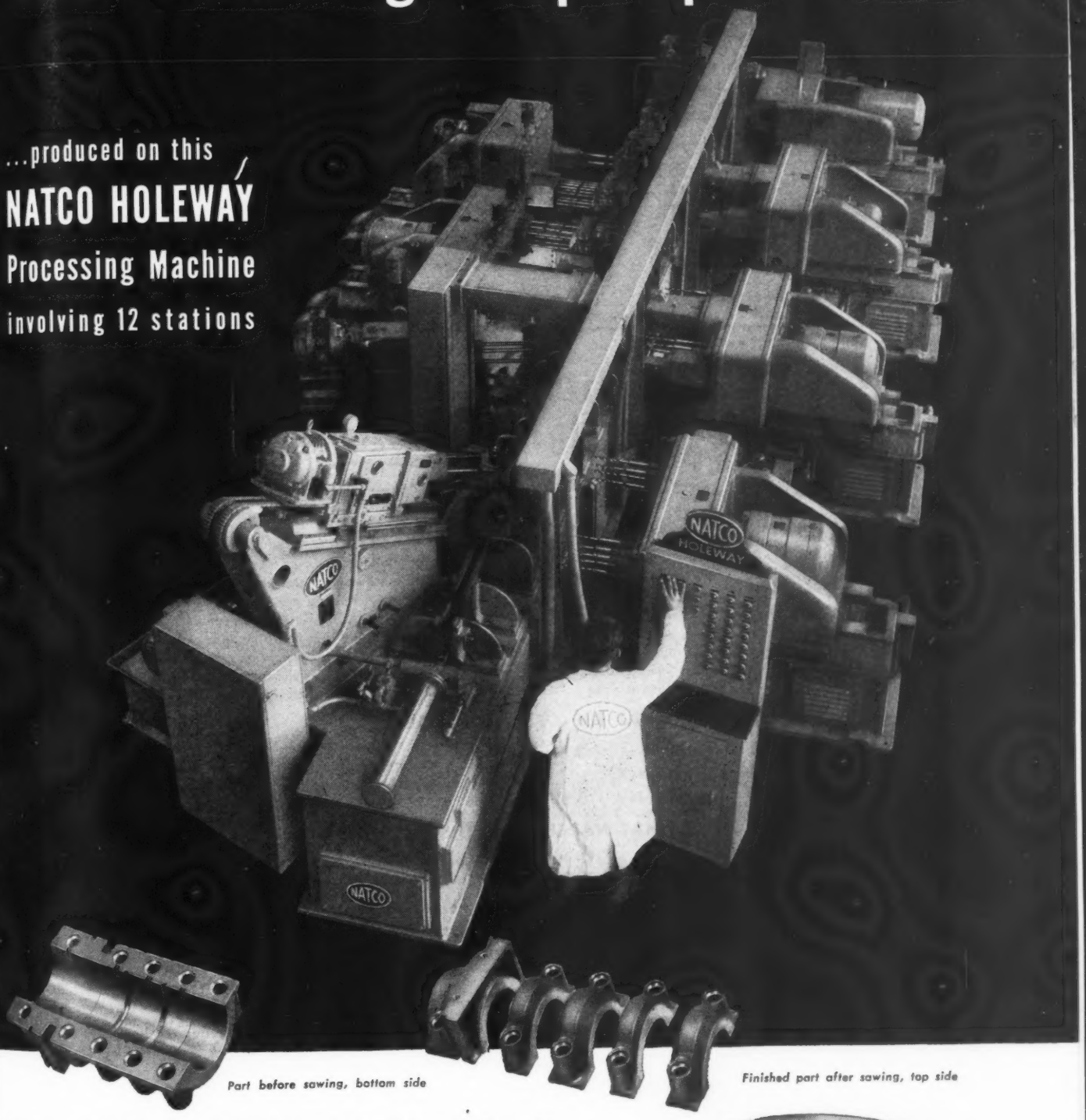
475 Bearing Caps per Hour

...produced on this

NATCO HOLEWAY

Processing Machine

involving 12 stations



Part before sawing, bottom side

Finished part after sawing, top side

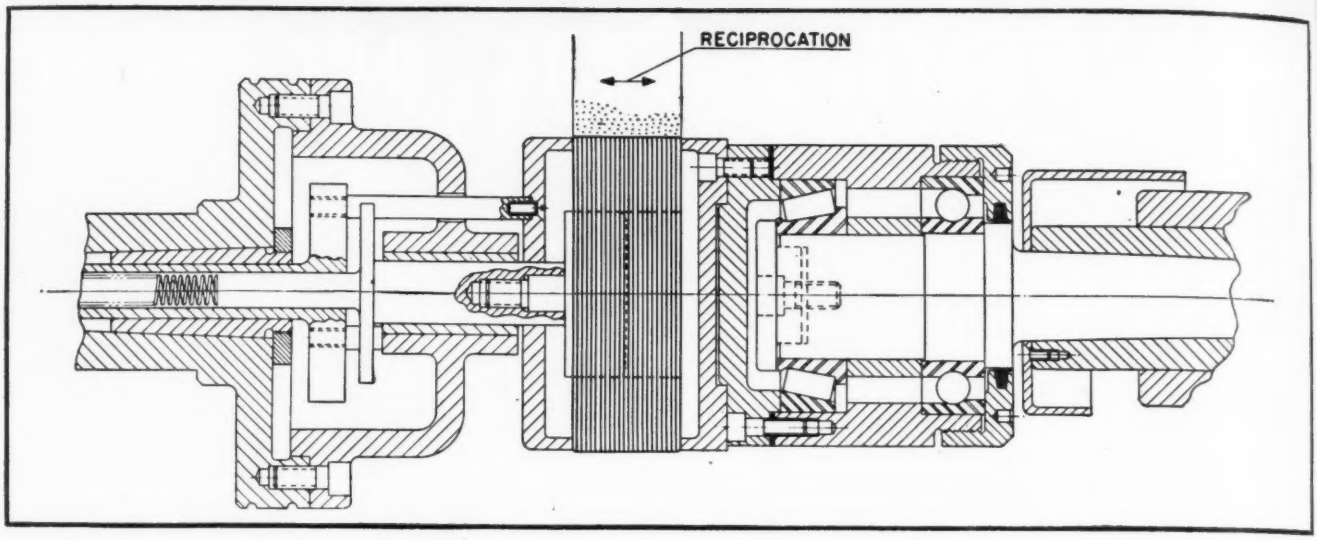
One man on this NATCO HOLEWAY Processing Machine produces 95 of these bearing cap sets (475 individual bearing caps) per hour

• In keeping with the trend to automatic handling — less operator fatigue and more production per man — NATCO provides this processing type machine arranged to complete the following operations between loading position # 1 and unloading position #12: drills 20 holes; mill chamfers both sides of center bearing; drills 2 angular holes; combination drills and countersinks 2 holes; chamfer 10 holes; taps two holes; countersinks 10 holes; spotfaces 10 holes; mills 5 bearing liner lock notches; saws finished bearing casting into five component parts as shown above—and unloads automatically.

NATCO

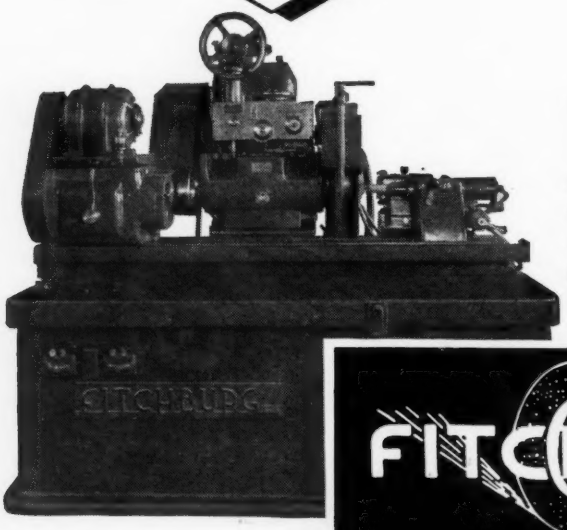
Write today for NATCO Machine Circular **145-M**

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, INDIANA, U.S.A. • *Branch Offices:* 1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City



THIS IS THE WORK...

THIS IS THE MACHINE...



Profitable Cylindrical Grinding by the FITCHBURG "Push-Button" method

Grinding the O.D. (4.375 ± .002") of Laminated Stator Cores

THE WORK:

Two FITCHBURG 6" x 24" Bowgage Plunge-Cut Grinders, Center Type, are being used in the plant of a motor manufacturer to grind the outside diameters of stator cores. The cores consist of punchings riveted together, the inside diameter being previously ground on another machine.

As shown above, centering is accomplished by sliding the core onto a spring-loaded centering plug. The headstock holding and driving fixture is a hydraulic type which equalizes the holding pressure and maintains the core in the correct grinding position relative to the wheel.

The ball-bearing tailstock center is attached to a hydraulic footstock. Adapters grip the punchings almost to the outside edge to prevent flaring of the punchings during the grinding operation.

WHAT THE OPERATOR DOES:

1. Slides the core onto the centering plug.
2. Throws over a hydraulic footstock hand valve. (This advances the tailstock center and causes the adapters to grip the punchings.)
3. **Pushes the "START" button** and turns to a *second* similar machine.

WHAT HAPPENS AT THE PUSH OF A BUTTON:

1. The work *automatically* starts revolving.
2. The Bowgage Wheelhead Unit *automatically* goes through its complete cycle:
   a. Wheel rapidly traverses to the work.
   b. Grinding feed diminishes as final size is reached.
   c. Wheel reciprocates 1/32" during entire cycle.
   d. Wheel rapidly returns to starting position.
   e. Wheelhead controls reset themselves *automatically* for the next complete cycle.
3. As the wheel draws away, the work *automatically* stops rotating. (Throwing the hydraulic footstock hand valve draws the tailstock away from the work, allowing the work to be removed and the next piece slid onto the centering plug.)

ONE OPERATOR CAN EASILY RUN 2 GRINDERS.

THIS PRODUCTION IS ON A 25 SECOND CYCLE, PER MACHINE — OR 300 PER MAN-HOUR.

If it's round ... and to be ground ... in mass-production quantities ... at a low cost per piece ... investigate FITCHBURG'S "PUSH-BUTTON" GRINDING.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders.

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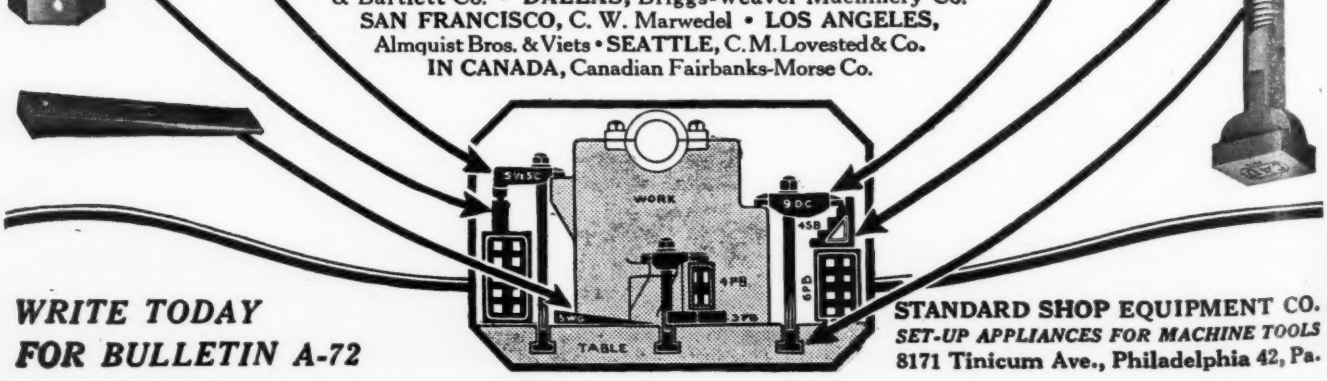

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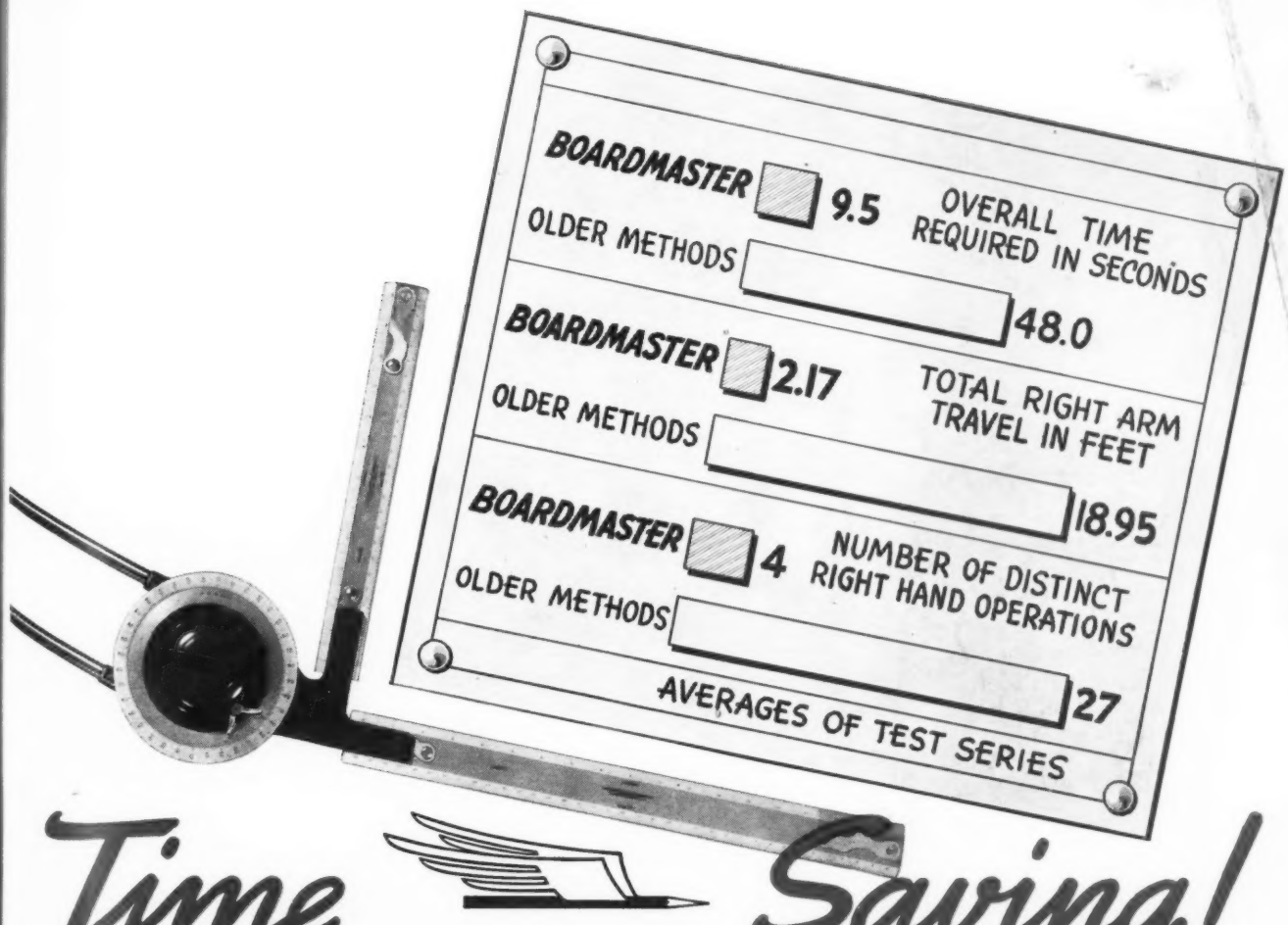

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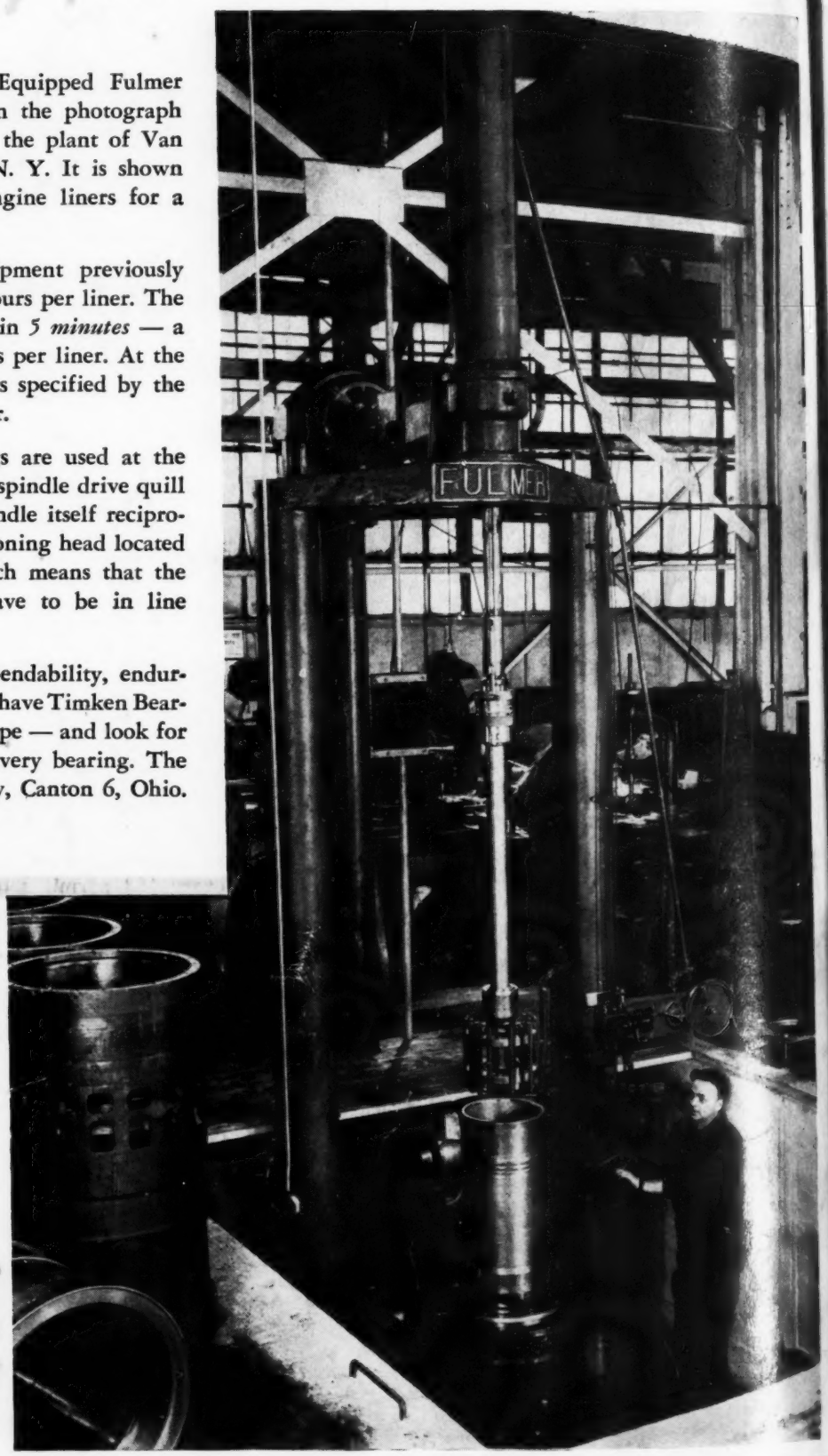

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